IN THE UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel, W.A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA, et al.	)	
Plaintiffs,	)	
V.	)	No. 05-CV-329-GKF-SAJ
TYSON FOODS, INC., et al.,	)	
Defendants.	)	

REPORTER'S TRANSCRIPT OF PROCEEDINGS

FEBRUARY 20, 2008

PRELIMINARY INJUNCTION HEARING

VOLUME II

BEFORE THE HONORABLE GREGORY K. FRIZZELL, Judge

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UNITED STATES COURT REPORTER

Exhibit C

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PROCEEDINGS

February 20, 2008

MR. JORGENSEN: Good morning, Your Honor.

THE COURT: Good morning, Mr. Jorgensen.

MR. JORGENSEN: May I start with a housekeeping matter?

THE COURT: You may, sir.

MR. JORGENSEN: When you get sued, it's the usual thing to come to court on hearing day, but the company Willow Brook asked if I would say to you that they're not here.

THE COURT: We got the notice. The notice that they

filed Monday, the one-page notice, was blank and then we asked them to refile it. That's what we anticipated.

MR. JORGENSEN: Okay.

THE COURT: Of course, when my clerk mentioned them, I said who because I'd not heard from them throughout this entire proceeding.

MR. JORGENSEN: Right.

THE COURT: And she reminded me that they were a non-participating defendant. And of course, they mentioned in their filing the cost of litigation. And certainly if one wants to take that sort of approach, then that's a viable approach, although risky.

MR. JORGENSEN: It is indeed risky. And I don't

represent them, but I did say to them just in case they knew about -- they knew about the blank filing and the concerns with getting their thing in. So they just wanted you to know that, you know, the reason they're not here is the cost of litigation has gotten to be so great that they're closing their operations in Oklahoma so therefore, they don't have to worry about, you know, an injunction would be forward-looking conduct.

THE COURT: Well, of course, you know, one has to question that rationale and the reality of that when in truth operations in Oklahoma and Arkansas are involved in this lawsuit. But in any event, I mean, that's their choice, so I've been aware.

MR. JORGENSEN: Great. Thank you, sir.

MR. BULLOCK: We will be filing a response promptly to their latest filing.

THE COURT: Is that even necessary?

MR. BULLOCK: Well --

THE COURT: To address the posture that --

MR. BULLOCK: Yes, and it will be a brief response, Judge. We're getting tired of writing as I'm sure your reading glasses probably need to be upped.

THE COURT: Well, I just did get a new prescription but you are not totally to blame in this lawsuit. Let's proceed.

MR. GEORGE: Your Honor, Dr. Teaf, I think, was the witness on the stand.

THE COURT: Yes.

MR. GEORGE: And we have, I believe, about 30 minutes of cross left.

THE COURT: Very well, Dr. Teaf. And doctor, let me remind you, sir, you remain under oath, if you would verbally acknowledge that.

THE WITNESS: Yes, sir.

THE COURT: Very well, Mr. George.

MR. GEORGE: Thank you, Your Honor.

CHRISTOPHER M. TEAF

Called as a witness on behalf of the plaintiff, being

previously sworn, testified as follows:

CROSS-EXAMINATION

BY MR. GEORGE:

Q. Good morning, Dr. Teaf. My name is Robert George. I don't believe you and I have had the pleasure of meeting before, have we?

A. No, sir.

Q. You said yesterday, Doctor, that you were paid $400,000 for your work in this case; is that right?

A. Yes, since August of 2004, about three and a half years.

Q. Did the attorney general's office make that payment?

A. I don't know who the checks come from to be honest with you.

Q. You don't know who is paying your bill?

A. I don't know who the checks come from. I'm working with the attorney general's office.

Q. You are not aware that your bills are actually being paid by the law firm of Motley Rice out of South Carolina?

A. I don't look at the -- I have not looked at the checks. I don't know how more clear I can be.

Q. Yesterday, sir, you showed us some bar graphs, and I refer you to Plaintiffs' Demonstrative 398. And if I understand,

this is a demonstrative that you put together; correct?
A. Yes, sir.
Q. And it reflects Campylobacter infection rates in Adair

County compared to the state average for the years 1998 through 2005; is that correct?
A. Yes, sir, it does.
Q. The 2005 bar goes all the way up to a line that says 45. Do you see that? It should be on the screen in front of you too, sir.
A. It's not.
Q. It's not, I'm sorry.
A. It looks to me like it goes to about 47.
Q. Okay.
MR. GEORGE: May I approach, Your Honor?
THE COURT: You may.
A. Thank you.
Q. (By Mr. George) Were there 47 reported cases of Campylobacter in Adair County in 2005?
A. It's 47 per hundred thousand which is what the left-hand axis said.
Q. Are there a hundred thousand people in Adair County?
A. No, sir.
Q. You didn't tell the Judge yesterday, did you, sir, that there were only -- this big spike in 2005 in Adair County was only 10 people over an entire year, did you?
A. No, I didn't make that point, no. I made the point that I made which is the rate is consistent.
Q. Let's put up Defendants' Exhibit 251.

A. Actually the exhibit that you just gave me is not the exhibit that's on the board.
Q. Okay. You can see this. I'll see what this is, thank you.
A. Yes, sir, thank you.
Q. Defendants' Exhibit 251. Doctor, do you recognize Defendants' Exhibit 251?
A. I don't know what you would like me to look at.
Q. Can you see the screen here? Is your monitor not working, sir?
A. It's not on.
Q. Should be on the monitor in front of you.
A. Okay.
Q. I'll hand you a copy as well.
A. Thank you.
MR. GEORGE: Your Honor, I should have asked to approach. May I have permission to approach as necessary?
THE COURT: You may, sir.
MR. GEORGE: Thank you.
Q. (By Mr. George) You recognize Defendants' Exhibit 251?
A. Yes.
Q. Do you see your -- I'm sorry, this is a document that was obtained from your files; correct?
A. Yes, I produced this during the time of the required production.

Q. And is this the underlying data that is obtained from the Oklahoma Department of Health by county for reported cases of disease in 2005?
A. Yes, sir, it is for Campylobacter, Cryptosporidium and for

E. coli.
Q. And I draw your attention to Adair County for 2005, the very first row conveniently. What were the number of reported cases for the entire year of 2005 of Campylobacter in Adair County?
A. There were ten.
Q. Now, ten reported cases of Campylobacter could be one problem at a restaurant; correct?
A. It could be.
Q. Could be one batch of bad hot dogs at a picnic; correct?
A. It could be, but the evidence or the information that we have indicated that both for Salmonella and for Campylobacter that was not the case.
Q. You investigated these ten cases, sir?
A. We spoke with the Department of Health and with the County Health Departments. And they were able to tell us for Salmonella certainly the indication was that the serotypes did not support the concept that it was a single event.
Q. Who did you speak to at the Department of Health?
A. I don't recall.
Q. Did the Department of Health tell you that they thought

these ten cases in Adair County in 2005 for Campylobacter were related to water?
A. They did not say that.
Q. Okay. They didn't tell you that these ten cases of Campylobacter in 2005 in Adair County were related to poultry, did they?
A. They didn't make that kind of a decision, no, sir. I think it's fair to say they generally do not.

Q. Sir, is there a reason that you selected only Adair County to show the Court yesterday in your demonstratives regarding disease incidents?

A. Campylobacter in Adair County was high and Adair County is immediately west -- the county immediately west of the Arkansas-Oklahoma border in the Illinois River Watershed. That's the reason that I selected it.

Q. You do appreciate there are four other counties in Oklahoma in this watershed; correct?

A. I do.

Q. And you didn't provide the Court yesterday in your testimony with any information regarding disease rates in those counties, did you?

A. No, sir, I did not.

Q. Do you understand that all of the float operators that we heard about from Mr. Tolbert yesterday are located not in Adair County, but in Cherokee County?

A. They are largely located in Cherokee County, yes, sir.

Q. Now, in your chart, you were comparing Adair County to the state average; is that correct?

A. Yes.

Q. Let's look at the data for Cherokee, Delaware and Sequoyah Counties, Defendants' Exhibit 251. Can you see it on the screen, sir?

A. Looks like the same exhibit to me.

Q. I'm sorry, it is the same exhibit. Were the disease rates for Campylobacter in Oklahoma in 2005 above or below the state average?

A. They were considerably above the state average.

Q. Considerably below.

A. Considerably above. You asked me for Adair County.
Q. I'm sorry, for Cherokee, Delaware and Sequoyah Counties, the other three counties, were they above or below the state average?
A. I see the first page. Cherokee County is below and Delaware County is below and Sequoyah County is below.
Q. But you didn't put that on your bar chart yesterday, did you?
A. No, sir, for the reasons that I've discussed previously. The passive reporting systems are useful as far as they go but they have limitations.
Q. So is it your testimony, sir, that these records are only

useful if they show a high incidence of disease and therefore supportive of the State's case, but they're not useful if they show a low incidence of disease?
A. No, that is not what I said, that's not what I think.
Q. You're relying on the Oklahoma data, are you not, for part of your opinion in this case regarding disease incidents?
A. Yes, sir.
Q. You believe that data is reliable insofar as you have considered it; correct?
A. Yes, sir.
Q. Let's look at Salmonella. You put this demonstrative up last year -- I'm sorry, yesterday. Seems like we've been here longer than we have. You recognize this as one of your charts; correct?
A. I do.
Q. You created that and, again, it stops in 2005; correct?
A. Yes.

Q. And again the disease incidence rate for Adair County for Salmonella in 2005 appears to exceed a line that has 40 out beside it. There were not 40 reported cases of Salmonella in Adair County in 2005, were there?

A. No, sir. This chart has the same Y axis as the previous chart which is rate per hundred thousand which is the way in which epidemiologic data for disease are typically reported.

Q. Do you know how many actual Salmonella cases there were in

all of Adair County for the entire year of 2005?

A. Not offhand, I don't.

Q. If I told you nine, would that surprise you?

A. No.

Q. Nine cases of Salmonella could be one bad batch of Aunt Edna's deviled eggs at a picnic; correct?

A. As I mentioned a moment ago, in this particular instance we know that that was not the case.

Q. Can you answer my question?

A. It certainly could be. But as one should do, one looks a little further and one finds that that's not the case.

Q. You investigated the nine cases of Salmonella?

A. We spoke with the County Health Department who was able to tell us that was not the case, your example is not the case.

Q. The County Health Department didn't tell you that those cases were related to water contact or to poultry in general, did they?

A. No, sir. Didn't ask that question.

Q. Why did you not ask that question?

A. That's not the information that they would typically have available. We asked whether they had seer type information which would indicate the answer to the question that you asked

which is did they come from a single event, and they did not.
Q. Let's go to Defendants' Exhibit 251. Once again, you selected Adair County and excluded from your graph Cherokee,

Delaware and Sequoyah County, did you not?
A. I didn't exclude anything. I presented the data that I presented.
Q. Are they on your chart, sir?
A. No, they're not.
Q. Okay. How many cases of Salmonella were there in Cherokee County in 2005?
A. I don't believe that's in front of me here.
Q. You can't see it on the screen? I'm sorry.
A. Thank you. Two.
Q. Two cases in the entire year of 2005?
A. Yes.
Q. How many cases of Salmonella were there in Delaware County in 2005?
A. Three.
Q. How many cases of Salmonella were there in Sequoyah County in 2005?
MR. BULLOCK: I object to the question as being misleading. These are reported cases, not total cases.
THE COURT: I think it's clear within the context to the extent that this witness is using this data. Overruled. Go ahead, Mr. George.
Q. (By Mr. George) Doctor, do you recall the question that was on the table? How many cases of Salmonella were there in Sequoyah County in 2005?

A. There were four.
Q. Let's look at another one of your demonstratives, Plaintiffs' Exhibit 404. This was a chart you testified from yesterday. We'll get it on the screen for you as well. You prepared this table of waterborne bacterial illness; correct?
A. Yes, sir.
THE COURT: Back up just a second, Mr. George. I take it we can stipulate that with regard to in all four counties, these are the reported case; correct?
MR. GEORGE: That's absolutely correct.
THE COURT: Go ahead.
Q. (By Mr. George) You created this Exhibit 404, Doctor?
A. Yes, sir, I did.
Q. Okay. You made a reference on this chart to E. coli including 0157:H7; do you see that?
A. Yes, I do.
Q. Do you see where in your description of related symptoms you included kidney failure and death; do you see that?
A. Yes, I do.
Q. Kidney failure and death are the types of symptoms that are related to E. coli 0157 in the most extreme instances; correct?
A. Absolutely, and I think I said that yesterday when I presented this chart.
Q. Now, there are thousands of different types of E. coli;

correct?
A. Yes, there are.
Q. Many E. coli are harmless; right?
A. Many are, many are not.

Q. This E. coli O157 is widely recognized as the most concerning human pathogen, correct, related to E. coli?
A. Well, there are a family of E. colis that are in that same grouping, but O157:H7 is the one that receives the largest amount of press, yes, sir.
Q. It's the one that we read about and hear on the news with regard to recalls of peanut butter and ground beef on occasion; is that right?
A. Typically it is O157:H7.
Q. And E. coli O157 is commonly associated with cattle; correct?
A. It's commonly associated with cattle and other things as well, yes.
Q. Now, the State of Oklahoma and its consultants in this case did not test for E. coli O157, did they?
A. No, we did the standard analyses for E. coli --
Q. Can you answer my question first? Did you test for E. coli O157?
A. I said no, and I'm giving you an explanation.
Q. I missed the no. Thank you.
A. I apologize. May I proceed?

THE COURT: You may.
A. The O157:H7 is a strain of E. coli. It was not specifically tested for. The standard methods for E. coli don't specify that or don't select out for that.
Q. But you could have tested for it if you wanted to; correct? There are methods that exist that allow you to determine the presence of E. coli O157, aren't there?
A. There are, but they're, as you know, different from

chemical analysis methods in that they require growth of the bacteria which is an issue in terms of identifying bacteria.

Q. I've put in front of you another demonstrative that you created and testified from yesterday as Plaintiffs' Exhibit 405. Do you recognize this document?

A. I do.

Q. It's entitled edge of field water samples equivalent to raw sewage spills; right?

A. Yes, sir, that's the title.

Q. Okay. And I -- I'm sorry, did I cut you off?

A. No, sir.

Q. There are, by my count, 28 edge of field samples displayed on this chart; does that sound about right? If you want to count them, you can. There are a lot of lines but in terms of locations.

A. That's about right.

Q. Okay. How many edge of field samples did the State of

Oklahoma's consultants collect in this case, was it just 28?

A. No, it was not.

Q. So this is a selection of the overall data but not all the data; correct?

A. Yes, sir, it is. And I think I was clear in stating that yesterday and what the criteria were by which I selected these.

Q. Do you know how many other edge of field samples that were collected that you haven't shown the Court in your exhibit?

A. No, I don't know the total number.

Q. Now, in looking at Demonstrative 405, your chart, a lot of these high values, over a million that you're talking about, MPM for 100 mil are related to total coliform, are they not?

A. Some of them are, yes, sir.

Q. Let's talk about bacteria for a moment and get a little deeper, if we can. Total coliforms are naturally present in the environment; correct?
A. They can be, yes, sir.
Q. Finding the presence of total coliform in an environmental sample does not suggest in and of itself a fecal source, does it?
A. It doesn't ensure that but it suggests that.
Q. Well, you can find total coliforms in the environment where there's no fecal matter whatsoever; correct?
A. Yes, sir, and I'll stick with my definition.
Q. Are you aware of any regulatory body, sir, that sets

surface water standards related to human health based upon total coliform levels?
A. Not anymore, that was true for many years but it is no longer true.
Q. Why is it no longer true?
A. Because there are better indicators now or there are more specific indicators.
Q. Such as?
A. Enterococci, E. coli and fecal coliforms.
Q. Enterococci, E. coli and fecal coliform are indicators of a fecal source, correct, whether it be human, cattle, any kind of fecal matter?
A. They are. In general, they are. You can do additional analyses to demonstrate whether there is or there isn't a known source.
Q. True. Now, let's go to Plaintiffs' Exhibit 400, another demonstrative that you have put forward discussing wells or, I

guess, actually groundwater samples. You prepared this exhibit; correct?

A. Yes, sir, I did.

Q. Now, how many of these little triangles, on this map that appear to cover the whole State of Oklahoma in terms of locations, are detections for total coliform as opposed to fecal coliform?

A. I don't think this covers the State of Oklahoma, I

think --

Q. I'm sorry. The Oklahoma portion of the watershed.

A. Yes, sir. And I'm sorry, the rest of your question?

Q. Certainly, sir. How many of these little triangles where you show the detection of bacterial contaminants are samples where the only type of bacteria detected were total coliforms?

A. I don't know that. There are some but I don't know the specific number.

Q. So you don't know what this map would look like if we took off all of the total coliform locations and focused on the ones where you actually found fecal indicator bacteria?

A. Well, let me take a step back for a moment and tell you that in groundwater many states do regulate total coliforms.

Q. Sir --

MR. GEORGE: Your Honor, and I apologize, but Dr. Teaf has ample counsel available to make the points that he wants to make.

Q. (By Mr. George) Doctor, I prefer that you'd answer my question.

A. I don't know that. And I was beginning to explain the reason why that's not necessarily so.

Q. You don't know how many of these triangles would disappear

if we looked only at the places where the sampling show positive tests for fecal indicator bacteria?

A. No, sir. Detected bacteria is typically the way in which

groundwater is assessed.

Q. Okay. But now the State, in its sampling program, didn't stop, in this case, its search by looking just for total coliforms. It went on and analyzed for fecal indicator bacteria; correct?

A. I believe in most of the wells the complete suite of indicator organisms was analyzed.

Q. Let's look at Defendants' Exhibit 301. Do you recognize this document, sir? And I can hand you, if it would help, a hard copy.

A. I'd like a copy of the whole thing.

Q. I think you can only see the first page.

A. Yes, sir. Thank you.

Q. You recognize this document?

A. Yes.

Q. You drafted this document?

A. Yes.

Q. It came out of your files produced in this case; correct?

A. Yes, sir.

Q. Do you see the reference at the top of the page to total coliforms?

A. Yes, I do.

Q. And then over to the right you see coliforms are naturally present in the environment. Those are your words; right?

A. Yes.

Q. Let's go to the second page.
A. I'll go to the second page but I, of course, think it's important that you read the whole thing or I wouldn't have written the whole thing. And there's quite a bit more information.
Q. And with all due respect, I don't have time to read the whole thing with you. But if your counsel want to get back up and read certain things, they can. Dr. Teaf, carrying over from the first page, bottom paragraph, you're talking about the main Department of Health and their position on groundwater and wells; is that right?
A. Yes.
Q. Can you read the first sentence of the quote there that starts with "It's okay"?
A. "It is okay to drink the water that tested positive for total coliform only if the lab also tested for Escherichia coli, E. coli or fecal coliforms and that result was negative, meaning they were not present."
Q. Now, back to, for reference, the map on the wells. Isn't it true, sir, that if we took off of this demonstrative that you prepared all the samples where you found total coliforms but you tested negative for fecal coliforms, this chart would look much less scary?
A. I don't know that.
Q. You haven't completed that exercise?

A. No, I have not.
Q. You were not trying to scare or mislead the Court by including total coliform values on this chart, were you?
A. No, sir, I wasn't. And I think it's important for the

reasons that I've said earlier that if you read this document, you will see that the reasons that we did it are the reasons that are important.

Q. Go back to your chart which is edge of field samples, Exhibit 405 for a moment.

A. Do you have a copy of that that I can look at from here?

Q. Is it hard for you to read on the screen, sir?

A. It is.

Q. There you go.

A. Thank you.

Q. You're welcome. Now, if I understood your testimony on direct, it's your view that the ranges of bacteria found in these 28 samples of edge of field locations resemble raw sewage; is that right?

A. They're consistent with the literature on spills of raw sewage in surface waters, yes.

Q. What literature are you relying upon for what I heard to be your testimony yesterday that raw sewage would contain around 100,000 MPN or CFU's per 100 mil?

A. I think what I said was that the range that's typically reported is a hundred thousand to a million and that was the

reason that I selected this range.

Q. A hundred thousand to a million?

A. Yes, sir.

Q. But you selected a hundred thousand yesterday?

A. I did to provide this guidance, yes.

Q. Let me hand you -- you're relying upon literature, correct, for that statement?

A. Yes.

Q. Can you identify the literature for me?
A. There's a lot of it. No, I can't produce a particular piece.
Q. Let's go to Defendants' Exhibit 302. I've handed you a piece of literature, sir. Are you familiar with the Biochemical Engineering Journal?
A. Not particularly, but I'm sure I must have seen a paper from it at some point.
Q. Do you have any reason as you sit here today to doubt the credibility of the Bioengineering Chemical Journal? Excuse me.
A. No, I don't.
Q. Okay. You'll see that from the title of this report that this is an article discussing the glamorous subject of the concentration of E. coli and other bacteria in sewage of influent; do you see that?
A. Yes.
Q. Someone -- for your benefit, sir, the authors of this

paper had the pleasure of studying concentrations of E. coli and total coliforms, for that matter, in raw sewage for an entire year. With that as context, can you turn to the second page -- actually third page? It's, for journal reference, page 121.
A. You don't even have to turn to that page. You can look at it in the abstract. It says 100,000 to a million.
Q. Well, turn to page 121, please. Do you see the sentence that begins with the annual average?
A. Yes.
Q. Can you read that sentence, please?
A. "The annual average concentration of total coliforms and E. coli were 5.8 times 10 to the fifth and 5.4 times 10 to the

fourth CFU per ML.
Q. Now, mathematics was never my strong suit, sir, I'll reveal that. Can you convert that for me to something equivalent to the values on your chart? Let's start with E. coli, what would 5.8 times 10 to the fifth for E. coli be?
A. 5.8 times ten to the seventh per hundred mils.
Q. Give me a number like yours. Is it a million, 58 million; what is it?
A. It's 58 million. It's important to realize this is an average. And you asked me to read it so I think it's important that we understand it.
Q. It is average.

A. That means that there are numbers that were higher than this and there are numbers that were lower than this.
Q. You don't believe there's anything wrong with using an average for comparison, do you?
A. As long as one understands what that really means.
Q. You use an average on your comparison of disease rates; correct?
A. Yes, sir, as long as one understand what that means.
Q. What about the 5.4 times 10 to the fourth, what does that convert to?
A. 5.4 million per hundred milliliters.
Q. And that's the average for which of these two, for total or for E. coli?
A. For E. coli.
Q. Let's go to Demonstrative Exhibit 23, let's start with E. coli. Sir, let's look at what your 28 selected edge of field samples -- how they would compare to the values we just

read as averages in the literature. Do you see that chart in front of you?

A. Yes, I do.

Q. Along the bottom axis are all of the 65 samples, edge of field samples that were collected, shown graphically in terms of their concentration for E. coli. And you see the bar across the top that should appear here in a moment that shows the literature referenced that we just read of 5.4 million for

E. coli. Your edge of field samples fall considerably short of that; correct?

A. They do and I don't find that surprising. You've selected a particular paper and that's not consistent with the general definition.

Q. Your highest E. coli number in the edge of field samples is about one-fifth the levels reported in this article for average raw sewage; correct?

A. Which bacteria did you ask about?

Q. E. coli.

THE COURT: I'm about to reveal my mathematical lack of knowledge, but having checked my seventh grade daughter's math, 5.4 times 10 to the fourth is 54,000, not 5.4 million. You just move the decimal point over four places; right?

THE WITNESS: Yes, sir, because it's per milliliter in the paper that he read and it's per hundred milliliters in the way that it presents on the chart.

THE COURT: Oh, okay. Thank you. Thank you.

MR. GEORGE: That's a good point, Your Honor. In fact, since this wasn't apparent to you it probably wasn't apparent to others.

Q. (By Mr. George) The values that you reported on your

demonstrative exhibit are for a hundred milliliters of water; correct?

A. In the standard way of presenting data, yes, sir, they

are.

Q. And so the more milliliters of water you report you use as your unit, the higher the value you are going to get in terms of bacteria; correct?

A. I don't know if I have to respond to that, that's pretty obvious, yes, sir

Q. Now, this article is reporting bacteria levels in mils, a milliliter of water; correct?

A. They selected that particular reporting format.

Q. There's nothing wrong with that reporting format, is there?

A. No, sir.

Q. And the conversion that you did earlier, you just built in a step, correct, you actually adjusted the units to make them comparable; right?

A. As you asked me to do, yes, sir.

Q. Thank you very much. So let's go back to the point then, sir. You do agree with me, do you not, that the highest E. coli value that you have reported in the 28 edge of field samples that you've shown is about one-fifth of this reported value for average E. coli in raw sewage in literature?

A. In this particular piece of literature that is correct. It is not my judgment that that's a representation of the literature in its entirety.

Q. Do you think these authors conducted a poor study?

A. No, they conducted a study on the place that they conducted their study in Japan. And I don't know how that reflects other -- well, I do know how it reflects other literature. This is not consistent with it.

Q. Can you cite me a piece of literature that would have a value that you think is more reflective? I'm interested in that.

A. I cannot do that as I sit here today, no. It's just knowledge that I have.

Q. So when you came to court yesterday and you testified that these values were in excess of raw sewage based upon literature, you're just relying upon reading literature in the past, but you don't have a specific reference in mind; is that right?

A. I do not. I'm working from 30 years of experience in the field, sir.

Q. Let's look at Demonstrative Exhibit 28. Let's compare your total coliform numbers. The literature value from the article that we just reviewed for total coliforms was 58 million per 100 mil; correct?

A. It was.

Q. Okay. The highest edge of field value that you reported in the 28 edge of field samples that you chose to show in your demonstrative was what?

A. Well, we don't really know how high it was. The caret

that points to the right indicates that it exceeded the ability of the assay to detect it. That is, there was confluent growth, it completely covered the plate. So it was greater than 1.6 million.

Q. But we can't quantify it; correct?
A. But we know that it was larger than 1.6 million.
Q. Okay. And if we use 1.6 million because it's the highest one we can quantify based upon the lab method that was put in place, would you agree with me that that value that you've reported for total coliforms is about 1/50th of the value reported in the literature that we just reviewed for total coliforms in raw sewage?
A. I would agree that that's the mathematics of it. And I would only point out once again that for a particular paper, you may conclude that.
Q. Sir, these edge of field samples, were you present when any of these were collected?
A. No, sir, I was not.
Q. Do you appreciate or understand that these edge of field samples were taken from ditches and puddles? Is that your understanding?
A. I would not have characterized it that way. Swales, standing water on the edge of field when it ran off the fields where poultry waste had been applied.
Q. Standing water on fields and water in ditches, do you

disagree with that?
A. No, sir.
Q. Were any of these edge of field samples taken from areas in which people recreate in water in terms of canoeing and floating?
A. No, that was not their intention. No, that was not their use.
Q. You were not trying to leave the Court with the

impression, were you, sir, that people are recreating in the Illinois River in water that is equivalent to raw sewage, were you?

A. I'm quite certain I never said that. And I think what I said yesterday very clearly was that these are indicative of the transport pathway from the field to the water bodies and they're indicative of the conditions immediately adjacent to those fields.

Q. Let's get it clear, if we can. You're not testifying, are you, sir, that people recreating in the Illinois River Watershed -- I'm sorry, in the Illinois River are doing so in water that is equivalent to raw sewage, that's not your testimony?

A. It is not my testimony with the explanation that I just provided which I think is an important caveat.

Q. Sir, how many of these edge of field samples were taken in or near pastures where cattle graze?

A. I don't know that.

Q. That wasn't important to your work in this case to know the answer to that?

A. It was not information that I know.

Q. Was it important enough for you to try to know it?

A. I believe that that information was decided upon by the people that were collecting the samples in the field.

Q. But you just don't know?

A. I do not know.

Q. Let's -- have you ever seen what a cattle pasture in the Illinois River Watershed looks like after an intense rainstorm?

A. Yes.

Q. Let me show you Defendants' Exhibit 27. It's on the

screen but I'll hand you a copy of it as well, sir. You talked yesterday in your direct testimony about these flakey, intact cow pies. Do you recall that?

A. I don't know if I used that phrase, no.

Q. That's what I understood. I thought your testimony, sir, was that a cow pie is like a Tupperware bowl turned upside down on the ground and it doesn't move. Did I misunderstand your testimony?

A. I certainly never used that analogy, no.

Q. Well, was that the point you were trying to convey is that a cow pie on a pasture is unlikely to contribute bacteria to an edge of field or to a water body?

A. No, the comment that I made yesterday was that it was less likely than poultry litter, given the size of the particles, and that it was a considerably important factor to be considered.

Q. How likely, sir, do you think it would be if we took an edge of field sample -- you see water on the edge of this field; correct?

A. I do.

Q. If we took an edge of field sample right there in the presence of all of this cattle and cow manure, do you think we would find high bacterial levels?

A. I suspect they would be elevated, yes.

Q. I'm sorry?

A. I suspect they would be elevated, yes.

Q. Do you think we would see them elevated to the level of what you are showing on demonstrative exhibit regarding raw sewage?

A. I don't know that.
Q. You didn't bother to test that possibility by going out and collecting an edge of field sample from a cow pasture and seeing how it compares?
A. I did not.
MR. BULLOCK: In terms of this picture, could we have some type of providence on it as to whether there was sampling or anything like that, is that the suggestion here?

MR. GEORGE: I'm making no suggestion other than that this is a pasture in the Illinois River Watershed. There will be a later witness who will authenticate this photo.
MR. BULLOCK: All right.
MR. GEORGE: Whether the State took a sample there or not, somebody from your team will probably have to testify to that.
MR. BULLOCK: You've got the data, too.
MR. GEORGE: Well, I don't have pictures.
Q. (By Mr. George) Dr. Teaf, with regard to your opinion that cattle feces deposited on a field is unlikely to make it to a water body, can you cite me to any literature that would support that opinion?
A. No, I think that given certain circumstances, it will. What I said yesterday and what I still believe to be the case is that it is much less likely than poultry waste given the caveats that I've provided.
Q. Can you cite me to any literature that has compared those two conditions in the environment and sources and come to the same conclusion that you've offered to this Court that poultry litter is more likely than cow manure to contaminate a water body?

A. The literature that is available, and I won't be able to cite you a particular paper because I've reviewed many, many, many papers in this area, is that given field application of

poultry waste, that both groundwater and surface water are contaminated in the immediate vicinity of that. Didn't have anything to do with data that we collected, it's information that's in literature now.

Q. Perhaps you misunderstood my question. My question, sir, was you offered the opinion yesterday that as between poultry litter and cow manure, poultry litter is more likely to get to a water body than cow manure. Do you have a study, sir, that has evaluated those two sources and reached that same conclusion?

A. No, I think that the physics of it are what I described yesterday and I think it's obvious that that would be the case.

Q. You're relying on physics. Do you have a degree in physics?

A. No, I don't.

Q. By the way, sir, are you -- you're a toxicologist by training, are you not?

A. Yes, sir, I am.

Q. You testified about fate and transport, are you a hydrologist?

A. No, sir.

Q. Are you a hydrologic modeler?

A. No, I'm not. I didn't testify about fate and transport. I testified about the fact that a toxicologist and a risk assessment person uses fate and transport information in the

work that we do.
Q. Well, let's back up because maybe I misunderstood.
MR. BULLOCK: Judge, we're well past the half hour, I just wonder when counsel is going to wrap up. I'm not trying to hold people to specific --
MR. GEORGE: Two minutes, Your Honor.
THE COURT: Very good.
Q. (By Mr. George) I want to make sure I understand, Dr. Teaf. You're not offering an opinion in this case regarding the likelihood of transport of poultry litter to a water body compared to other sources; is that correct?
A. No, I'm not. No, I'm not. I'm identifying sources, and I'm identifying receptors.
Q. In fact, yesterday when you talked about -- I think you threw out some percentages in terms of cattle manure versus poultry litter. You were talking just about your analysis of how much hits the ground, not how much gets to the water; correct?
A. And subsequent to that I discussed the importance of knowing how it may make its way to the water body, yes, sir.
Q. But you're not offering an opinion as to whether it got there or not because you're not offering a fate and transport opinion; correct?
A. Well, I am offering an opinion about that it got there and I'm offering it for two reasons. One, the bacteria levels are

very high and second of all, the signature that was identified is of cattle -- is of poultry.
Q. You're relying upon the work of Dr. Roger Olsen for your belief that the water shows the evidence of poultry

contamination; correct?
A. In part I am and I'm also relying upon that of Dr. Harwood and the other lines of evidence that I described yesterday.
Q. But you yourself, sir, have conducted no fate and transport analysis; correct?
A. No, I did not, not a formal one, no.
Q. Sir, based upon the work that you've done in this case, not the work of others, can you state to a reasonable degree of scientific certainty that if Judge Frizzell grants the injunction that is requested by your client, the water quality standards for bacteria in the Illinois River will be met in 2008 and 2009?
A. My opinion is that they will be.
Q. Can you state that opinion to a reasonable degree of scientific certainty?
A. I can based on the information that I have reviewed.
Q. You're willing to stake your professional reputation on the proposition that if this Court enters the injunction sought by your client, the water quality standards for bacteria in the Illinois River will be met next year?
A. Based on all the information that I have and my knowledge

of microbial growth in the environment, I believe that to be the case, yes.
Q. You're willing to stake your professional reputation on it?
A. I don't know what you mean by that.
Q. Well, sir, if you offer an opinion and it turns out that opinion is incorrect, perhaps your reputation has been jeopardized. So my question is do you have the confidence in

the opinion that you just expressed that you're willing to stake your professional reputation on it?

A. Sir, if I didn't think that was the case, I wouldn't be here.

Q. Okay. Now, sir, you've done no analysis to quantify the relative sources to a water body; correct?

A. I think this is about the same question you asked me a moment ago, and we looked at loading and we looked at sources in the water bodies of what the bacteria were coming from.

Q. But you conducted no fate and transport analysis to see which of those sources actually impacts the water body more substantially; correct?

A. I think I've answered that. I think that we have done it.

Q. Have you done that?

A. I have reviewed information that the team has provided that answers that question for me.

THE COURT: I think we've answered that question.

MR. GEORGE: He's not going to -- I just want to make sure that someone doesn't get up later, Your Honor, and say that Dr. Teaf has conducted the fate and transport analysis here.

THE COURT: I think we've plowed that ground.

MR. GEORGE: Okay. I'll pass the witness, Your Honor.

THE COURT: Mr. Bullock.

REDIRECT EXAMINATION

BY MR. BULLOCK:

Q. Just a few things. Dr. Teaf, yesterday Mr. Tucker presented some information concerning TMDLs in various watersheds, for instance the South Canadian?

A. Yes, sir.

Q. What does the information discovered in producing the TMDL for the South Canadian River tell you about sources of pollution in the Illinois River Watershed?
A. It tells you absolutely nothing and it would be dangerous to make assumptions between watersheds.
Q. Okay. Now, a great deal has been made about the issue of finding Campylobacter or Salmonella. Is it not -- can you not culture those organisms so that you can count them?
A. Under certain circumstances it's possible to do so but both of those organisms, and E. coli as well, are well-known to be stressed in the environment to the point that they are not culturable. They're not able to be tested in a lab or grown up

in the lab, but they're perfectly infective, the bacteria are alive and well. So it's an interesting problem. It's been identified in the literature many times. And it's a real public health dilemma because you can find illnesses and you can know that the bacteria are present in the water, but you can't find the bacteria in the water because of its viable, but nonculturable state.
Q. Now, also yesterday there was examination of -- do you recall the 2007 study that the EPA did concerning the use of the indicator bacteria?
A. Yes.
Q. What was the conclusion of that study as you understood it -- or that review?
A. That there are reasons to want to try to identify better ways to do this, but that at the present time there are not those ways. They are not available to us in a commercially applicable way that states can implement. No states have

changed their positions as far as I know because of that draft report.

Q. Well, what is -- following that review, what changes were made in water quality standards in this nation?

A. None.

Q. If we take out the current water quality standards, if we eliminated them, if we didn't follow them, what would we have to guide us in terms of health risks in the water bodies of

this nation?

A. Nothing.

Q. Now, Mr. George asked you about the data concerning the various counties that parts of which are Oklahoma counties, parts of which are included in the Illinois River Watershed. Do you recall that examination?

A. Yes. Yes, I do.

Q. You chose to display the data from Adair County; correct?

A. Yes, sir.

Q. Why is Adair County important?

A. Adair County is the county which is almost and totally encompassed by the Illinois River Watershed.

Q. Okay. And is there anything else about the location of Adair County that makes it important?

A. It's immediately adjacent to the State of Arkansas as well.

Q. Okay. And what do we find a concentration of in the State of Arkansas?

A. Chicken.

MR. BULLOCK: That's all, Your Honor.

MR. GEORGE: Your Honor, could I follow up on one area?

THE COURT: Yes, sir.
MR. GEORGE: It will be very brief.
THE COURT: Yes, sir.

RECROSS-EXAMINATION

BY MR. GEORGE:

Q. Dr. Teaf, you were just questioned by your counsel regarding Adair County. You did not show the Court the disease rates reported for Salmonella for Adair County in 2006, did you?

A. No, I did not.

MR. GEORGE: May I approach, Your Honor?

THE COURT: You may.

Q. (By Mr. George) I'll hand you what is Defendants' Exhibit -- let me get a number here -- 201.

A. Yes.

Q. It's again the data from your files regarding reported disease incidents in Oklahoma counties; correct?

A. For Pertussis, Rocky Mountain Spotted Fever and Salmonellosis.

Q. And in 2005, we saw that the -- what looks like 47 was really 10 cases. Do you recall that?

A. I recall explaining to you what that meant.

Q. Did the disease rate for Salmonellosis in Adair County, which is entirely within the Illinois River Watershed and closest to the farms in Arkansas for chicken, go up or go down in 2006?

A. I don't think I have that figure.

Q. Should be on what I just handed you. Do you see the Adair

County Salmonellosis, far right-hand column number?
A. I'm looking for the '05 as well. I think that was the comparison you just asked me for.
Q. It was. Have you found it, sir?
A. Yes, I have.
Q. What was the rate in 2005 -- or the number of reported cases in 2005?
A. It was five and the rate was 23.77 per hundred thousand.
Q. I think you are looking at 2006.
A. In 2005, it was nine and the rate was 42.78 per 100,000.
Q. So the number of reported Salmonellosis cases in Adair County in 2006 dropped by about half?
A. Yes.
Q. You didn't choose to show that to the Court?
A. I had prepared this exhibit before I got that information.
Q. You didn't have this information in your possession when you prepared this exhibit?
A. No.
MR. GEORGE: Thank you, Your Honor.
MR. BULLOCK: Just very quickly.
THE COURT: Well, I'm going to stop it here, no re-redirect.
MR. BULLOCK: Okay. That's fine, Judge.
THE COURT: You may step down.
THE WITNESS: Thank you, sir.

THE COURT: The plaintiff may call its next witness.
MR. GARREN: We call Dr. Fisher, Your Honor.
THE COURT: Dr. Fisher, welcome back.
THE WITNESS: Thank you, Your Honor.

JOHN BERTON FISHER

Called as a witness on behalf of the plaintiffs, being first duly sworn, testified as follows:

THE COURT: If you will state your full name for the record.

THE WITNESS: John Berton Fisher.

THE COURT: Mr. Garren.

MR. GARREN: Thank you, Your Honor. Richard Garren for the State of Oklahoma.

DIRECT EXAMINATION

BY MR. GARREN:

Q. Dr. Fisher, tell the Court generally the highlights of your education for us, please.

A. Yes, I received a bachelor's degree of geology and geophysics from Yale University in 1973, master's degree in earth sciences from Case Western Reserve University in 1976, and a doctorate in earth sciences from Case Western Reserve University in 1979.

Q. Thank you. And what is your current profession, sir?

A. I would describe myself as a geologist and geochemist mainly focusing on environmental matters.

Q. Is there a particular area in environmental matters that you have addressed with regard to this case?

A. Yes, I've addressed two things in this case. One is the generation of waste from poultry operations, the disposal of waste from poultry operations, and the fate and transport of waste from poultry operations and its constituents.

Q. Do you hold any registrations or certificates?

A. Yes, I'm a member of the American Society of

Professional -- American Institute of Professional Geologists and I'm a registered professional geoscientist in the State of Texas and a registered professional geologist in the State of Mississippi.

Q. I'll point out to you, sir, there's a packet of documents in front of you which are exhibits that we'll refer to in your testimony. Would you please look at --

MR. GARREN: And Your Honor, I believe that packet has been handed up to you for your use and benefit, working copies. The top one would be the curriculum vitae for Dr. Fisher.

Q. (By Mr. Garren) Dr. Fisher, looking at State's Exhibit No. 154, is this a true and correct copy of your curriculum vitae?

A. Yes, it certainly appears to be. Yes, it is.

Q. And is it current?

A. It's the most current one, I believe, yes.

Q. All right. This is a document you prepared, is it not?

A. It is.

Q. Explain, if you would, what experience you have in engineering and science with regard to environmental litigation matters.

A. Well, I'm not going to claim that I'm an engineer, that's a matter of professional registration. But in terms of experience with engineering science, I have extensive experience in environmental matters in terms of agricultural waste here most recently, industrial facilities, mainly petrochemical industry production facilities, oil and gas production and waste attendant to that. And I've worked in numerous aspects of litigation, administrative and transactional matters. And I've worked on water resource

issues in the State of Oklahoma as well.
Q. How long have you worked as a professional in the geochemist and geologist area?
A. Probably since 1973, '74.
Q. All right. Does your professional experience also include hydrogeological matters?
A. Yes, I've done quite a bit of work in hydrogeology.
Q. And it has, I think you said, included some with regard to environmental contamination from waste?
A. Yes.
Q. Tell the Court briefly what that experience was.
A. Well, those experiences have been both industrial as well

as oil and gas. And that is looking at data and sometimes collecting information on the chemistry of groundwater and attempting to understand the movement of contaminants in the subsurface and their sources.
Q. Is that movement the same thing you might refer to as fate and transport?
A. Yes, that's what fate and transport is. It sounds like sort of an ethereal thing. It's not, it's just things when they enter the environment, how they move about in the environment.
Q. All right. And you've had experience in testifying in courts and administrative hearings before this date?
A. Yes, I have.
Q. Describe for the Court, if you would, please, what were the tasks that you were asked to perform with regard to your professional expertise.
A. I was asked to do a couple of things. One was to assist

in and make an estimate or assist Dr. Engel in making an estimate of the amount of poultry waste generated within the Illinois River Watershed and assess how that waste was disposed. And then to examine the underlying geology of the circumstance and look at what transport paths exist and what likelihood materials would have of entering various other environmental medias, specifically surface water and groundwater.

Q. Are you here today to testify on behalf of the State as its expert on those matters?

A. I am.

Q. And did you collaborate with any others in performing these tasks that you described?

A. Yes, I collaborated with numerous individuals in terms of professionals who would have assisted me or I would have assisted them in various plans. It would be Dr. Engel from Purdue University and Dr. Olsen from CDM. I also have a staff of individuals who have skills in spatial analysis and data manipulation, data abstraction. And a team of investigators who were almost all -- all but one, I believe, were off-duty Tulsa Police detectives, predominantly homicide detectives and including the Chief of Tulsa detectives who worked on this matter for me.

Q. So those people worked under your direction, is that what I understand you to say?

A. That's correct.

Q. What generally were the duties of the homicide detectives for the Tulsa Police Department?

A. Well, they had two primary duties. Their primary first duty was to assist me in ground truthing an aerial photograph

which I suspect we'll talk about later. That is, assessing on the ground what the facts were that we thought we might have seen from the air. And then two, to make observations

concerning the locations of poultry waste disposal and, to the extent possible, to trace those disposal activities back to the source of where the waste had been generated.

Q. When did that work that you just now described as being performed by these officers, when did that work start?

A. Both of those tasks began in 2005. Earliest part of 2005 was primarily looking at waste disposal. And then as 2005 progressed, as the air photo was assembled, we used them to do ground truthing, but that was beginning in about 2005 and through about the summer, mid-summer of 2007, those tasks were ongoing.

Q. Was there a strategy employed by you to perform the tasks that the State asked you to do?

A. Yes.

Q. And who helped or who participated in developing that strategy?

A. Well, in terms of getting a waste estimation, Dr. Engel primarily. And also in looking at where waste was disposed, he provided me some information that would be helpful in that regard.

Q. Regarding the implementation of that strategy, did you take instruction and supervision from Dr. Engel then?

A. Yes, yes, we were basically his hands and arms, eyes on the ground, the muscle that would conduct the tasks that he designed.

Q. Let's talk a little bit about the specifics then of what was done in the ground truthing as you've talked about and identification of poultry houses. We have a board up, I believe it's State's Exhibit 429 -- I'm sorry, 427, Your Honor. When you talk about ground truthing an aerial, does State's Exhibit 427 give an example of the aerial you spoke to?

A. Yes, it gives two examples. An air photo was taken by a contractor, an Oklahoma contractor, in the spring of 2005. The photograph was flown at a resolution of seven-tenths of a meter which is about 30 inches.

Q. What does that mean?

A. Well, that means that you can discern on the ground things that are just around two feet in any small dimension. So if I had a basketball, I would be able to tell that there was something like a basketball on the ground, be a little smaller than two feet.

Q. Okay. And was that aerial photograph used in identifying poultry structures within the IRW?

A. Right, the first task in looking at that was that we have a very good idea of what poultry structures look like. Every structure that could potentially be identified as a poultry structure was identified with a unique number on that in the million acres of watershed that were reviewed in the air photo. We knew that there was a roof, there was a long, skinny building that looked like a long, skinny metal building.

Q. If we look at State's Exhibit 427, in the upper left-hand corner, Your Honor, do we see a blow-up of a barn in this part of the photograph?

A. Yes, we do. This is a -- in fact, that's a barn blown up

in that part of the photograph, yes.
Q. It reflects a number on it. Is that unique to that barn?
A. That number is unique to that barn.
Q. And is that true with regard to the other structures that are identified in the aerial that look to be similar poultry-type structures?
A. That is correct. Every structure that had a characteristic -- those characteristics was identified with a unique number.
Q. Did that unique number then form the basis of a database you created -- or began to create?
A. Yes, that was the unique number forming the basis that said there was a structure on the ground that possibly was a poultry-related structure.
Q. Did part of your tasks that you were to perform include identifying these structures or associating them with a bird type and an integrator?
A. Yes, I probably should back up, though. The investigators were given the latitude and longitude coordinates in GPS units that they were able to go out into the field and wherever they could observe from public right-of-way, would observe and

determine that we had structures that we had counted. They would record any signs -- or photograph those structures, photograph signage, photograph addresses. And the thrust there -- and also make observations and take notes on types of activity, were ventilators running, were curtains closed, were workers coming in and out, were barns open, were there any smells, noises, that kind of thing.
Q. Were the investigators provided a form prepared by you or

others to use in that regard?

A. Yes, they were provided with a form to do the site investigation work and record that data.

Q. And were those forms then filled out in the field by them when they did this?

A. They were.

Q. And on those forms, generally tell the Court what other items or things that are on there that you haven't already stated.

A. Well, it would be the photographs that were made, the latitude and longitude of where they made the observation from. Again, any photographs -- they would strictly take photographs of signs, notations as to -- many of the signs would designate who the integrator was that facility was growing for, that would be noted on the form as well.

Q. What was done with the forms when those were prepared?

A. Well, the forms -- part of the data from the forms, being

the house number and some conclusions to whether they were active or inactive and the integrator, that sort of data was abstracted into our database and associated with the original house number. Some of the structures clearly were not poultry related. Some were clearly active, chickens were being loaded in or out of them. Some of the structures couldn't be seen from the road, they were unknown. Some of the structures had been -- were no longer in active operation or used to store boats or hay. That information was abstracted into our database.

Q. You now mentioned aerials and investigators and their reports. Were there other data that you considered with regard to identifying houses and integrators and poultry in general in

this watershed?
A. Yes, the tax documents, those documents from the assessor's office of the relevant counties, which would be Benton County, Arkansas, Washington County, Arkansas, Delaware, Cherokee, Adair and I believe Sequoyah County, although there's not much there. Those records were consulted. And those counties assess a tax on the birds, on the inventory of birds and that tax is paid by the integrator.
Q. So you could link up an integrator with a number of birds based upon that report?
A. Yes, because it listed the name of the grower. It would list the -- actually it would be done by integrator, generally

done by integrator and done by school district where I suppose the tax is going, but that's a supposition. It would be the integrator is identified, the grower's name would be identified, the type of bird being grown would be identified, the number of birds in inventory at that time would be identified.
Q. All right. Were there other governmental agency reports that you also looked to in order to assist in creating this database?
A. Yes, within Oklahoma because there's a poultry registration law there at that time, there are reports from the Oklahoma Department of Agriculture, Food & Forestry which I'll refer to as the ODAFF records. The poultry registration information there provides information concerning the location of poultry facilities, the names of the operators, the type of birds, the number of birds, the capacity of that house and the number of flocks per year that are produced.

Q. And the type of birds?
A. And the type of birds, yes.
Q. Did the ODAFF records also give information with regard to waste disposition or waste generation?
A. Yeah, they gave information with respect to waste disposal. There are really two sets of records in that. One is a set of records that are related solely to the growers who may also be waste disposers, and also to what are called waste

applicators would be people who don't necessarily grow but do apply. Those records, the intent appears, certainly the data structure is available to indicate the location of origin to the nearest public land survey section of the waste, the location of disposal of a given sortie of waste or a number of loads of waste to a given public land survey section, the date upon which that occurred and the number of tons that were disposed.
Q. Was that data compiled?
A. Yes, it was.
Q. And was that data provided to Dr. Engel?
A. Yes, it was.
Q. All right. Backing up some more. Are there other documents such as census reports that you might have reviewed?
A. Yes, that's more -- we're going from specific to more general information. I also reviewed the U.S. Department of Agriculture agricultural census information which is generally done on a five-year basis between about 1950 and 2002 for the relevant counties. That data is reported on a county-wide basis.
Q. Were you provided documents from the actual defendant integrators of this case?

A. Yeah, eventually we were provided with those documents. And those documents were quite helpful because they also identify names of growers, addresses of growers. They give

driving directions to grower locations, in some instances identify types of birds, capacities, number of flocks, just a variety of information concerning the operations of each of these locations.

Q. Since your deposition in this case, have you had an opportunity to review the expert declarations of the defendants?

A. I have.

Q. And I believe you spoke to some governmental records. Did you also refer to what I would state as outside the state of Oklahoma governmental records?

A. Yes, yes, I have. Sorry, I didn't mention them because they're not very specific. There are records that are compiled on a county-wide basis, and as I understand it, the reporting was required by law in 2007. So in 2007, we have records of waste generation and disposal in a general sense from Washington and Benton County, from the ANRC, Arkansas Natural Resources Commission which would have been their report on a county-wide basis. Actually, their report on a county-wide basis and they are grained specifically to identify what watershed they're in. They do not identify specific locations. The Benton County records in 2007 do identify integrators on a line-by-line basis. It appeared that the records I received which were in spreadsheets had been redacted as to specific grower information but still retained information -- an

individual row in that table was a location, but there's no way to know that.

Q. Is the documentation and the literature you described something that you, as a scientist, would normally rely on in setting up a database to locate generation of poultry waste?

A. Well, sure. You want to identify that there was a source, that the source was active. And then you would want to know the kind of source it was and how large that source was and then with respect to who might be responsible for the source.

Q. Did you look at published literature to assist you in evaluating practices with regard to growing poultry, disposing of or handling the waste generated by that poultry?

A. Yes, I did. I looked at dozens and dozens, maybe hundreds of reports of various kinds, both from -- we can call it conventional scientific literature, that's from peer reviewed journals, to publications from universities through extension services that are used for agricultural education and dissemination of information to growers, governmental reports, I mean, just literature of many different types.

Q. Are you familiar with a person by the name of Sheri Herron?

A. Yes, I am.

Q. And are you familiar with a company that she is associated with called BMPs, Inc.?

A. Yes, I am.

Q. Were you provided data from that entity?

A. I was. I was provided information concerning the transport of poultry waste, specifically by watershed with other -- some fairly specific information for 2005 and 2006 and

part of 2007, as I recall.
Q. All right. And was that information that you looked at concerned with only the IRW?
A. No, it was not.
Q. Did you restrict your reliance or use of that material to only the IRW?
A. With respect to the transport in and out of the -- if I was looking at transport of litter or waste from the IRW, I would only look at material coming out of the IRW. So the answer to that is yes. I looked at all the information, though.
Q. All right. Did you also have available a source of information from what's referred to as the Eucha-Spavinaw waste management team?
A. Yes.
Q. Describe the kind of records and information that was made available to you from them.
A. Yeah, the Eucha-Spavinaw Watershed management team was set up to administer poultry waste disposal within the Eucha-Spavinaw Watershed as a consequence of the City of Tulsa litigation. In the course of performing their court-supervised

duties, the Eucha-Spavinaw Watershed management team, under the special master, wrote what are called animal waste management plans for each of the facilities within the Eucha-Spavinaw Watershed. The Eucha-Spavinaw Watershed is of interest because it's immediately contiguous to the Illinois River Watershed, one. It also has similar operations and involves the defendants, these defendants. So it has interest.
This is one of the only -- in fact, the only instance

I know of in which there is a complete suite of animal waste management plans that were written by a very small group of people clearly under the supervision of a federal court. So these would be reliable, one would presume them to be reliable sources of information concerning the generation of animal waste and its disposal.

Q. So of all these things you've spoke about, were they considered or relied upon in providing the data necessary for Dr. Engel to make his analysis?

A. They were.

Q. Just let me ask you this. In review of these documents and the literature and the information you just described, were you able to determine if each of the defendant integrators in this case were active in growing poultry in the IRW during 2004 to 2006?

A. I was.

Q. And what was your opinion based on that?

A. The opinion was they were.

Q. All right. Did you personally perform any work in the field within the IRW yourself?

A. Yes, I did. I made numerous trips into the watershed for various purposes, both on the ground and aerial reconnaissance and surveillance operations, as well as numerous extensive amount of time spent on Lake Tenkiller. So I think, gosh, all in all I probably spent 60 full working days in the IRW since this began.

Q. You're familiar with a company called CDM that's been referred to, I believe, and Dr. Olsen?

A. I am.

Q. And did you have an opportunity to work with or see them

doing their work in this matter?
A. I did.
Q. And did you observe any sampling being performed by them at any time?
A. Yes.
Q. So that the Court can maybe understand the magnitude of this, first off, describe how many people were in your employ at any given time when you were doing the work as tasked by the State of Oklahoma.
A. I think at our peak, and this would include the investigators as well as temporary employees, somewhere, you know, in our little shop, somewhere north of 30 individuals,

all told over the course of time.
Q. Did you have an opportunity to determine the extent of the manpower used by CDM in their work?
A. I certainly did have the opportunity to examine it. I would have to look at detailed records of how many people, but it was a lot. My recollection is I can recollect maybe 20 individuals who worked in the field.
Q. Let me ask you, sir, do you have experience with regard to managing or supervising personnel in a research facility or capacity?
A. I do.
Q. Tell the Court briefly what that is.
A. In the 1994 and '95 time frame, I was an acting research supervisor at Amoco Production Company supervising a group of ten professionals writing budgets, designing research programs.
Q. Is the work that you did there in some way similar to what you've described what you did for this case?

A. Well, it didn't involve any poultry, but it was substantially similar. It would be planning operations and executing operations in the field, just doing science, collecting data and organizing it into reports and reporting that information to our management.

Q. After the gathering, organizing and analyzing this data, when was the time that the experts, in your opinion, reached a consensus they could demonstrate there was a serious problem

that could be attributable to a source within the IRW?

A. With respect to the experts looking at all the historic information as well as the existing information, I'd say that a consensus began to develop in the fall of last year and then crystallized pretty quickly after it began to develop.

Q. When you were in the field, did you make your own direct observations?

A. Well, sure. I mean, you can't help but when you look, to see things, sure.

Q. In that regard, let's look at State's Exhibit 429 that I've placed up on the easel. Can you tell the Court what we're kind of looking at here and let's kind of break it down and first talk about the photos? We're seeing -- what are we seeing in these photos?

A. The photos going across the top from left to right, what we're seeing is a photograph. And in the top left there's a spreader truck, it's being loaded by a front-end loader. Immediately below that are the notes from the investigators that are associated with that photograph. It's a particular --

Q. Sir, let me interrupt you a second. The document that looks to have handwriting on it below the photo, is that an exact copy of the field sheet that the investigator might have

made or did make at the time that photo was taken?
A. Oh, that is the field sheet they made that's correlated with that photo. The photo is identified by a frame number

DSCF 5182, also by a Bates number which, of course, came later. But that particular frame number is identified by 5182, I believe, if I can read from this distance, on that sheet, so it relates to that particular sheet. So that's a load-out of waste.

In the second, the photograph in the top middle is a load of -- the first facility by the way is that's a Tyson-related facility. In the second photograph, that's a load of waste from a Peterson facility --

Q. That's the truck in the middle photograph going down the road?

A. In the middle photograph going down the road. In that particular case, that is in Arkansas and the waste is uncovered. In the third photograph at the top is a disposal operation. It's a spreader truck in a field in Arkansas. The source of that waste could not be identified.

Q. We're seeing what it looks like when dry poultry waste is spread on a field in that photo; is that correct?

A. Yes, sir.

Q. All right. Tell us what the two tank trucks are in the middle and lower left-hand corner.

A. It's the same truck, for starters. That particular truck is from -- operated by an outfit called TRS. They were loading their waste from a George's Egg facility. In this case, the waste that's being applied is a liquid waste. And in the

first -- the frame on the -- in the center is that truck heading south very near to the road. What you'll see in the background is a pond. And then the second photograph in the lower left is the same truck circling on the other side of the pond.

Q. And again, the documents that are associated with those pictures are the field sheets by the homicide detectives observing that when it occurred; is that true?

A. Right. And you'll note there that's an earlier observation before we developed -- we fully developed a more organized means of keeping the information from the spring of '05.

Q. With the investigators utilizing GPS units, the lower right-hand corner, do we know, in fact, where that photograph was taken?

A. Yes, we do. Each location, the protocol was to identify the point of observation from where the photograph was taken and then -- so we know where the picture was taken, we do.

Q. Do you know where that picture was taken that's shown in the lower right-hand corner of this exhibit?

A. I do.

Q. Where was it?

A. It's, I think, about three miles southeast of Siloam Springs. It's on the shore or the banks of the Illinois River. And that particular truck had George's written on the side of

it.

Q. Are these photos and field sheets exemplary of the type of material and data that was compiled in order to identify poultry waste in the watershed?

A. Yes, they're exemplary. We have more of the organized sheets than of the disorganized. I shouldn't say disorganized, but the earlier free form ones. But they are exemplary, that is that there be a photograph taken of an activity, notes made concerning what that activity was, a location recorded, latitude and longitude recorded of where the activity was observed, the time recorded and we know who the recorder was from the notebook or the sheet.

Q. I placed on the easel another set of photographs and field sheet notes. Tell the Court what it is we're looking at in these and explain to the Court the time frame that we're looking at in the photos.

A. Okay. What you're looking at there, Your Honor, on this particular diagram which is State's Exhibit 428, is a pile of poultry waste that's sitting in a field next to a small drainage that leads to Cincinnati Creek and then on to the Illinois River. This is in Arkansas. The particular ranch or the particular facility is a Simmons facility. The house is off to the right and it was called the Hat Creek Ranch. The time frame that we're looking at here spans from April -- end of April of 2005 through, I believe, June, mid-June of 2006.

And what this reports -- and in fact, this particular pile also or -- shows up in our aerial photograph.

Q. Let me pull that out again. I'll just set it down below.

A. If you take a look at that exhibit, an air photo in the right-hand photograph which is the Hat Creek Ranch, and look immediately to the west, to the northwest corner of the facility, you'll see an area that's sort of brown. I'm looking at this from a distance too. But that particular brown spot on

the ground represents the location of the pile of poultry waste.

Q. Why don't you step forward and point to the exhibit so the Judge can see what it is you are referring to.

A. In this exhibit, Your Honor, this reddish-brown area here is that first pile of poultry waste. This is Weddington Creek here that drains close by, that drains into the Cincinnati Creek and on into the Illinois River.

Q. Is the board that we are looking at, Exhibit, I think, 429 or 27, does that show the location of that particular farm in the watershed?

A. It does, it's right here.

Q. And is that an example of where the houses have been identified by number and unique number for purpose of tracking records?

A. Yes, in fact, here's the public roadway, the trail right in front of the houses. They're identified by numbers 1343

through 1350.

Q. Okay.

THE COURT: The piles shown in 428 are located where on 427?

THE WITNESS: The ones that are shown in early April are back here by this corner, in April of '05, Your Honor. And as we move forward in time, the pile -- there's a new pile here in '06 that shows up there. It's not that it's persistent.

THE COURT: That's on the Arkansas side?

THE WITNESS: It is on the Arkansas side, yes, Your Honor.

THE COURT: That's a Simmons facility?

THE WITNESS: Yes, Your Honor.

THE COURT: Uncovered?

THE WITNESS: Uncovered. In frame DSCF 2657 which is the central frame which is a photograph taken on June 22nd of 2008, the field notes for that frame are immediately above it, describes a downpour of rain falling on the uncovered pile.

Q. (By Mr. Garren) Dr. Fisher, I think you said June 22, 2008, did you mean 2006?

A. Oh, I'm sorry, I do mean 2006, that is correct. Of course, from a distance and in the lower right-hand corner, that's the pile in 2005, the same one that's figured in the upper left. And in that pile, you can see the feathers sitting on top of the waste.

Q. What did you generally learn from your investigative team and your personal observations in the literature, the defendants' records and the database from ODAFF with regard to the generation of waste in the watershed by these defendants?

A. Well, all of the defendants generated waste within the watershed.

Q. In your research and investigation, did you form an opinion about the further use of poultry waste after it's been removed from the poultry house?

A. Well, it's not used for growing poultry. It's disposed by surface spreading in fields.

Q. All right. And let's change the subject a little bit and talk a little bit about the other tasks that you were asked to perform about fate and transport. You've told the Court what that means. Does fate and transport -- when considering that, is the geology, the terrain and the soils significant or important?

A. Well, they're very significant. It's the stage upon which the play is made.

Q. What did you do in this particular case to ascertain the terrain, soil and geology of the Illinois River Watershed?

A. Well, a number of things. One was I reviewed geological data, generally in map form or in map form for Oklahoma and Arkansas. I reviewed our aerial photograph or directed its review for looking for lineaments which are linear arrayed

features often indicative of fractures. We reviewed geologic reports, including various theses written out of the University of Arkansas. In terms of soils, I examined the data present in the U.S. Department of Agriculture soil surveys for these counties and looked at the hydrologic characteristics of those soils.

Q. And I assume you made direct observations yourself while in the field?

A. Well, sure, sure. We were in the watershed for a considerable period of time.

Q. Okay. Did you prepare a chart for the Court in order to help explain that karst geology?

A. I did.

Q. Let's look at Exhibit 430, State's Exhibit 430. And if you could, quickly run through these and explain to the Court just what is occurring in the Illinois River Watershed.

THE WITNESS: May I -- Your Honor, may I go to the diagram?

THE COURT: Yes, sir.

THE WITNESS: Would that be helpful?

THE COURT: Yes, sir.

A. There are four panels in this diagram. Let's start with

the upper left-hand panel. This shows the outlying boundary of the Illinois River Watershed. The bold black lines indicate major map faults. Those are map -- present in geologic maps.

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So these are major breaks in the rocks that comprise the bedrock here. The lighter black lines are major lineaments that we were able to identify from air photos, and they correspond to other work done, much more detailed work done on lineament identification in Arkansas.

Q. What is a lineament for basic --

A. A lineament really is just a linear feature that one can see in an air photo. In this kind of terrain, we're sitting here in what's called the Springfield Plateau. It's part of the Ozark uplift, an uplifted feature in Arkansas. It's a dome. The dome spills and dips off to the west. It's why the rivers sort of run in a circle around the edge here in Oklahoma. It's why the Arkansas runs the way it does because it's running around the edge of that. The structural development of that dome, plus subsequent structural crustal deformations take place after all the bedrock that's here in this watershed has been deposited. And so what that means is all these fractures can penetrate every bedrock unit that's present because the fracturing happened after the bedrock was made.

So if you wanted to sort of paint a brush over this, this place is broken like a cup. The drainage features within this watershed are generally structurally determined. They're flowing along zones of crustal weakness, along fractures. So that's what that says. We have a structurally modified bedrock

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that's controlling the terrain.
Q. What's the effect of this fracturing and the faulting that you are describing that's in this watershed as it pertains to the land spreading of poultry waste?
A. Even with kinds of rocks that aren't soluble like a granite, this would provide a conduit for waste deposited on the surface and their constituents to move directly into groundwater. The bedrock that's present here in the near surface is the Boone limestone and the Saint Joe limestone, which are both soluble. So this fracturing combined with the soluble nature of those rocks mean these fractures become enlarged by dissolution. And so these become very, very good pathways for wastes that are present on the surface to enter the subsurface.
Q. Before you move forward, I want to make sure that we established what is the material or the data that you relied on to prepare this demonstrative exhibit today?
A. These are published diagrams, the citations for which are given. These are Reese-Whiting 2003, was a thesis at the University of Arkansas. Reese-Whiting prepared this diagram based on diagrams of others. But this diagram is from Imes 1994 which is a USGS publication specific to the Ozark uplift which discusses the Springfield Plateau. And this particular diagram is from a thesis by Mr. Hanson written in 1973 and based upon the Latin and Parizek 1964 diagram.

Q. Is it fair to say that it's been fairly well-known about the condition of the karst mantle terrain that exists in the IRW?
A. The first time any geologist would have walked through

here, they would have recognized this as karst terrain.
Q. Okay. Go ahead, if you would then, let's finish off the poster board and each individual -- the remaining three diagrams and explain generally what it is these are trying to portray for the Court.
A. Certainly. In this diagram in the upper right that we're looking at here is a very general overview. Which when waters enters this watershed, we all understand that this is the watershed boundary. It's a bowl that water can only exit only via two ways. Either it evaporates into the atmosphere or it flows out through the Illinois River into Lake Tenkiller and then ultimately to the Arkansas River. There are only two ways out. So precipitation -- but there are a lot of pathways in between. Precipitation would fall on this. What this is attempting to show is a zone of unsaturated material in pink. And below it, a zone of saturated material where there would be groundwater that the stream that's flowing here in the unsaturated zone could be a losing stream. That is because these rocks are quite porous and permeable because of their fractures, what's called secondary porosity, the water can readily move -- be lost in that stream. Similarly --

Q. When you say it's lost, where does it go?
A. Into the groundwater below the surface. Similarly, water from the groundwater can reemerge in what are called gaining streams. That is when the stream is sitting at the level of the groundwater, groundwater will flow into that body of water and flow on. And we see numerous springs here. A spring is simply a location where the surface of the groundwater has intercepted the surface of the earth. So these are all

features that you would anticipate seeing in a karst terrain. You can see them in any kind of terrain but the karst terrain, in particular, because you can think of these rocks as having pipes cut through them, big cracks that readily pass water vertically which is what this is attempting to show.

Also the cracks are at multiple origins. In the lower right-hand diagram, what's attempted to show here are two fractures traces intercepting. There's been work done with water resources attempting to better locate water wells for better yield. In this sort of terrain, the primary porosity, that is the porosity of the rock itself, is generally not very high. Most of the porous face that transmits water is secondary, that is, it's fractures and expanded fractures. So if you can try to set your water wells into areas where fractures intersect or fracture rich areas, you'll have a higher productivity well. That's been the overarching theory. But this is showing fracturing. It also, in terms of faulting,

which are big fractures and big fractures which are little faults, if you will. It also shows jointing. As the rock is unloaded, as the pressure load comes off this rock, as materials are eroded away from the rock, the rock expands. Rocks are very weak in tension and they crack, and that's jointing. Joints generally don't penetrate very deeply but they do provide other avenues for water to enter the rock and dissolve it. So that's that circumstance.

This is trying to put it all together in a cross section. The soils here, there are really two types of soils primary. One are the soils that are residual soils. This is called a mantled karst. If you drive through this area, you don't see that much exposed bedrock. The rock has been

dissolved at the surface and it has left behind the material that didn't dissolve which is very cherty from the Boone, rocky. It leaves rocky material in place, things that we would think of as a soil. It's not like soil in Iowa where you have meters of thick black soil, but rather fairly thin loamy, soils below which are materials that are sort of rocky, rocky residual left from weathering of the limestone. There are also soils that form, alluvial soils here, a material that's swept down into the river basin. Those would be the two major soil types.

What this diagram is trying to show is there's leaking of the residuum, the solution-altered surface,

solution-enhanced cracks and fairways which lead to here in what would be called the vadose zone. That is the zone that's below a permanent, more or less permanent water table, within the Saint Joe limestone having fairly cavernous -- large cavernous porosity being present here. This -- the attempt here is to show that this stream is in a fault. This would represent the Chattanooga Shield which is generally referred to as an acquacludenous area, an area that is a basin. And it probably generally is, but fractures can penetrate that. But here is where this particular block is up-thrown, and this particular block is down-thrown and the river has developed within it.

THE COURT: Well, but the uplift occurred under the Chattanooga; right?

THE WITNESS: It did and so the Chattanooga could be penetrated by faulting, that's correct, Your Honor. So I think that's all I really wanted to say about this diagram is the

attempt to explain the circumstances of the geology and part of the soils. With respect to the soils themselves, it's simple here. For fate and transport, we're not so interested in the hundreds of soil types that are present but rather in their hydrolic behavior. In the central, this slopes this way. Water flows downhill. We might as well say that. It may seem silly, but it's true. The land over here in Arkansas and into the northeastern portion of Oklahoma is a little bit flatter.

It's more open because it's flatter and easier to make into pastures. As we enter Oklahoma, the streams become more deeply in size. Along the Illinois River, you'll see the high bluffs along that river. And there's less pasture here, more pasture type areas over here.

The soils that exist in the west, from about here in the western portion and -- I'm sorry, the eastern portion and the far western portion are more -- have more runoff potential. When it rains on it, the somewhat less porous materials tend to run off. The soils in the central portion, sort of the sweet spot, if you will, the central portion of the watershed tend to have higher degrees of infiltration. So when it rains, it can generate less runoff, but more water will be able to infiltrate through these soils. The soils themselves are not homogenous perfect pieces of Saran wrap that -- or beds of activated charcoal that can take up contaminants and scrub everything away. They're really, they're fairly thin. The layer that can do that is fairly thin. They are very rocky and some of them are quite permeable. And that's all I have to say about that document.

Q. (By Mr. Garren) Go ahead and have a seat. Having described this geology, in some way the hydrogeology, what

effect does it have with regard to instances of application of poultry waste to the surface?

A. It sets up a circumstance in which poultry waste applied

to the surface and its constituents, which would include particles like bacteria, have a ready ability to penetrate quickly into the subsurface. The average residence time of groundwater within these shallow aquifers here is about four to six years which is very, very brief certainly in geologic terms. So when material hits the surface, it readily enters groundwater. It also means that groundwater here can easily become surface water and surface water can easily become groundwater.

Q. Is that a term that you refer to as like charge and recharge of a stream or is that different?

A. Well, you can call them these gaining and losing streams. You know, streams -- in karst terrain, a stream can be running along and for no apparent, obvious reason just disappears into the subsurface or you could see a stream reemerge to the surface.

Q. You alluded to the type of soil. Here in Tulsa we have some pretty good loam and nice thick soil. Tell the Court what is the kind of soil that you do see on the surface of this particular watershed?

A. Well, let's talk about the term loam. Loam simply means there's roughly equal proportions of clay, silt and sand plus organic matter. And these tend to be loam soils. What is significant here is how much of the soil is fertile. Limestone derives soils. They're derived by this sort of process of

dissolution and leaving behind a residuum, are notably infertile in their native state. So this leaves behind a thin, rocky, infertile soil without any additional intervention by people.

Q. Is it permeable?

A. Yes.

Q. Are you familiar with a local study in Arkansas referred to as the Savoy experiment?

A. Well, I'm familiar with the Savoy Experimental Station which is in Washington County, a bit west of Fayetteville. And it's the hydrogeological experiment station for the University of Arkansas.

Q. Do you know what was studied there?

A. Numerous aspects of karst geology and hydrogeology including experiments that released clay particles and bacteria at the surface in a losing stream, an intermittent losing stream, and then examined what came out of springs fed by this recharge area. And it found that the particles could travel through the karst system and exit at the spring. In some instances -- I understand Ralph Davis provided a talk about this two years ago. In some instances, the particles can actually beat the dissolved phase because they have a vertical component. They're falling through the water, but the material that's dissolved in the water is only moving at the velocity of the water.

Q. Who is Mr. Davis?

A. Ralph Davis is a director of Water Resources Institute, if I recall that correctly, at the University of Arkansas.

Q. Water Resource Center?

A. Yes.
Q. All right.
THE COURT: What was the name of that study?
THE WITNESS: It's present in a thesis and I can't recall the study right now, Your Honor, but I can get that information to you.
THE COURT: I was just curious.
Q. (By Mr. Garren) Have you had an opportunity to review literature and analytical data with regard to the constituents that are found in waste, poultry waste particularly?
A. I have, I have.
Q. Tell the Court what kind of materials you might have looked at to familiarize yourself and educate yourself on those issues.
A. Looked at two things. Literature reports concerning the constituencies of poultry waste, including bacteria. You have to look on the input side as well. So I also looked at feed formulation information provided by the defendants. Looked at reports generated from the University of Arkansas with respect to composition -- research the compositions of waste. Looked at manure composition information or poultry waste composition

information that was present in the Eucha-Spavinaw records. Looked at our own data, of course, on composition of poultry waste.
Q. All right. Did you determine as part of those constituents whether there were any metals found?
A. Any metals found?
Q. Yes.
A. Yes, there are.

Q. What kinds of metals did you find that shows up in the analytical reports?

A. The things that are classic. Arsenic is found but it's classically -- it's really not a metal, but it's generally described as one. Arsenic, copper and zinc are commonly found because each of those is added to feeds for nutritional purposes. And we also find a substantial amount of phosphorus because that's added for nutritional purposes as calcium phosphate.

Q. Have you also reviewed studies concerning identification or verification of poultry waste or its constituents in the runoff of lands within the IRW?

A. Yeah, I have. I've looked at experimental studies concerning runoff from poultry waste applied to experimental plots.

Q. Are those studies peer reviewed to your knowledge?

A. Yes, I believe they are. University of Arkansas has done

work on some test plots within the IRW.

Q. And can you tell the Court what was found with regard to those test plots and the runoff of poultry waste?

A. Okay. Well, of course, the test plots themselves are mainly focusing on nutrients, but it says phosphorus comes off both as -- particularly if you look at the literature in general, phosphorus both as particulates and as dissolved material exits poultry waste when water impinges on it, as does arsenic, copper and zinc-containing materials. Basically if it's in the waste, it's in the runoff.

Q. All right. Generally what becomes of the poultry waste constituents after they leave the fields in this runoff?

A. Well, as they leave the fields in the runoff and probably

in some instances even if they don't leave the field as runoff, they -- once it's been put on the field, it's entered the environment. Once water has -- enough water has been put on this, if a material is present in the runoff, it enters ephemeral drainageways and those drainage ways lead to permanent streams. And so runoff from fields enters streams. And as you can see in this sort of terrain, some of that material will also infiltrate and enter the groundwater.

Q. Did you, as a result of your work for the State of Oklahoma, did you make an investigation as to whether constituents from the poultry waste have traveled from the land areas within the IRW to this catch basin at Lake Tenkiller?

A. I have.

Q. Tell the Court what was the nature of that investigation.

A. That was a classic paleolimnological investigation which is a fancy way of saying looking at the history of Lake Tenkiller. Lake Tenkiller closed its dam in about 1954 and began to accrue its pool. Up until that time sediments that were derived from within the Illinois River drainage were transported through the Illinois River on into the Arkansas River and they would have transitory storage as flood plain sediments within the Illinois River Watershed. Once the dam was built, that dam began to capture some sediments. And then there would be secondary processes taking place there as well because some of the material that would be dissolved would be processed by algae and those algae would be eaten by fish and then defecated by the fish or would settle directly to the bottom. So some of the material dissolved in the water would become solid and end up in the lake sediments.

Q. Did you yourself undertake an investigation of those lake sediments?

A. I did.

Q. And tell the Court what you did in that regard.

A. Two things. There was a primary phase of investigation of doing a subbottom profile work with low frequency sonar. That's sort of like doing seismic. What you would want to establish are areas where sediment was thick and take a look

also at areas where you believe the sediment would not be disturbed. That is, you would have an undisturbed history of the lake.

Q. What's the purpose of it being undisturbed, is that important?

A. It is important because then you would have a continuous record of deposition. Every time a particle falls out of the water, it lands in the sediments and it stays in the sediments. We also wanted to capture materials from the bottom where there would not be much bioturbation. What bioturbation is, is the creatures that live in the bottom, stir the mud up. Lake Tenkiller, for good or ill, is a great place to do that because nothing virtually lives in the sediments.

Q. Let me ask you this then. Were samples taken from the bottom of Lake Tenkiller?

A. Yes, yes, they were. Samples --

Q. Describe the procedure and how that happened.

A. Samples were collected from the lake using a scuba diver who advanced a coring tube or coring tubes into the lake bottom until refusal or until he couldn't push it in any further. The top of that core was then capped. The diver then dug down next to the core and capped the bottom. That's a standard method

for doing diver-collected coring. Those cores are placed in a carrier and returned to the surface where they were examined for whether or not they had been disturbed. They were then

carried to shore. And much like pushing grease out of a grease gun using a piston in the bottom, the sediment was advanced through the tube and cut off in well-defined intervals, generally one or two centimeter intervals depending on the purpose.

Q. What happened to those cuttings, if you will, those layers of the core after they were cut?

A. They were analyzed for a couple of things. In one instance, their chemistry was analyzed for a wide variety of chemical constituents. And in the other instance, they were analyzed for their content of lead-210. Lead-210 is a naturally occurring radio nuclei. And by measuring the activity, how much decaying lead-210 is present in the sediment in excess of what is generated within the sediment, one can determine the age of that sediment. Plus, there's some geologic keys on age that is at the base of one of the cores, the core intercepted flood plain sediments, ancient soils, that would be 1954 or earlier material. We also would have the top of the core, and that's today. So the lead-210 allows you to date every segment of the core.

Q. I assume there's an analysis made of those core samples and the cuttings that we've talked about, the slices, if you will?

A. Yes.

Q. What did you learn from that analysis?

A. Learned from that analysis is that the level of total phosphorus in those sediments increased, has increased in time from the beginning of Lake Tenkiller to the present. And that in correlation with that, the concentrations of copper, zinc and arsenic have increased as the phosphorus -- with the phosphorus concentration.

Q. When you say as or with, do you mean they were correlated or describe what you mean?

A. I mean they are correlated. There's proportionate increase in copper, as with phosphorus increase. For just an example, I increased phosphorus by ten, copper might go up one, but it's a strong correlation between increase in phosphorus and the increase in copper, zinc and arsenic.

Q. So all three of those chemical elements increased in some correlation directly related to the increase in phosphorus, is that what you're saying?

A. That's correct.

Q. What does that tell you, what do you conclude from that?

A. Well, it tells you that they have a common source.

Q. And can you tell from that what you believe may be the common source?

A. Based upon the work conducted by Dr. Olsen as well as this primary work of looking at feed constituents and waste constituents, the source of the phosphorus and source of the copper, the zinc and the arsenic in this lake is from poultry

waste.

Q. Did your consideration of this data also take into consideration the human population growth?

A. It did.

Q. And did it take into consideration any cattle growth that occurred in that area?

A. It did, but in point of fact, you wouldn't have to. The cattle are not -- there are numerous depositions in this case and my own personal observations that there's very little feeding of cattle that takes place here.

Q. What do you mean by that?

A. Well, food is not dominant. The cattle do not eat food that is imported, that's not their dominant source of feed. Certainly they're fed a bit in the winter but that's not their dominant food. They eat grass.

Q. And the grass that's grown in the IRW?

A. That's correct. And a very significant paper written in 2004 by Slaton and others from the University of Arkansas that looks at nutrient mass balances within the State of Arkansas doesn't consider cattle at all because they simply consider them as recycling the nutrients being put down on the ground from poultry.

Q. So you put the poultry waste on the grass -- or on the ground to grow grass. The cow eats the grass, defecates and leaves it back where it was. Is that what you're saying?

A. That's correct. Well, it takes some out. If you export the cattle, they'll export some of the materials that they've ingested and incorporated from the grass.

Q. Dr. Fisher, do you have an opinion whether the karst geology of the IRW, as you've explained to the Court, allows for the transport of poultry waste constituents into the surface waters in the IRW?

A. Yes, I do.

Q. What is that opinion?
A. Well, the karst geology permits more ready transport of materials into the surface water. In the absence of the karst, the only pathway would be overland flow really.
Q. And as an expert for the State of Oklahoma, do you also have an opinion whether that same karst geology allows for transport of poultry waste constituent into the groundwater of that IRW?
A. I do.
Q. What is that opinion?
A. My opinion is that karst geology here in the Illinois River Watershed facilitates the transport of poultry waste and its constituents into groundwater.
MR. GARREN: Thank you. I'll pass the witness, Your Honor. But I would point out that in the event of any page line designations, we would like for those questions to be propounded to the witness live today so that we can have the

opportunity to release him.
THE COURT: You're saying to the extent that we refer to deposition --
MR. GARREN: Yes, sir.
THE COURT: -- you'd like a reference to page and line?
MR. GARREN: Well, no, what I'd like is for the questions and answers to really be made live so that we'd have an opportunity to go ahead and cross-examine Dr. Fisher while he's here.
MR. GEORGE: I don't understand the issue.
THE COURT: I don't understand either. I mean, the typical practice is if they're going to cross-examine on the

basis of deposition, he's got to give page and line. Is that what you're talking about?

MR. GARREN: No, no, no.

MR. EDMONDSON: Your Honor, he's talking about as opposed to introducing depositions at a later date.

MR. GARREN: Right, right, as opposed to coming back later and introducing a deposition, we'd ask that those aspects of that deposition, those questions and those answers be presented live today so we can proceed.

THE COURT: Well, we're going to make a decision soon after the following of this hearing. I mean, I don't have time to spend a lot of time poring over additional deposition

testimony. I mean, that's certainly not something we're going to do here. I mean, I've got, believe me, I've got lots of cases. I've got to make a decision and go on. I don't understand what you're saying.

MR. GARREN: I think what I'm trying to suggest is that that would avoid that opportunity for you having to read additional depositions.

THE COURT: Well, we're not going to do that. We're simply not going to do that. We're going to take whatever you've submitted here and we're going to make a decision. I've got 200 other cases.

MR. BULLOCK: But this is the thing that I want to be sure that we're clear on. What I anticipate in looking at their deposition designations is that when they start their case, they may plan on putting on Dr. Fisher by deposition, that is playing video of his deposition. What we're saying is, as with any case, if the witness is available, they ought to

call him and put him on live rather than doing this by deposition later.

THE COURT: Mr. George, any response?

MR. GEORGE: No, Your Honor -- yes, Your Honor. It's not our intent to do that. We certainly reserve the right to recall Mr. Fisher if something comes up at a later date.

MR. BULLOCK: Sure, absolutely.

MR. GEORGE: But it's not our intent to spend an hour

and a half with Mr. Fisher today and then play an hour and a half of video of him in our case-in-chief.

THE COURT: Sounds like we are jousting with possible phantoms.

Dr. Fisher, I've got one question that keeps coming back in my mind in terms of the geomorphology of the Ozark uplift. Is it more of a dome uplift or -- what was the nature of the uplift?

THE WITNESS: It's a doming, sir.

THE COURT: Okay. Do we need to take a break? Let's take about a 10 minute recess and we'll be back.

(Recess.)

MR. GARREN: Your Honor, I omitted one question and then I've got a little cleanup on the exhibits and I'll be out of here.

THE COURT: Go ahead, sir.

MR. GARREN: If I may.

Q. (By Mr. Garren) Dr. Fisher, in gathering information in the data and analysis you made, did you share any of that with a gentleman by the name of Gordon Johnson?

A. Yes, I did.

MR. GARREN: And Your Honor, I would move for the

admission of the demonstratives that were referenced in Dr. Fisher's testimony.

THE COURT: Admission of the demonstratives or

admission of the exhibits?

MR. GARREN: Of the exhibits, yes.

THE COURT: Very well. Any objection?

MR. GEORGE: No objection.

THE COURT: Very well, the exhibits are admitted. Mr. George?

MR. GEORGE: Your Honor, while we're on the housekeeping vein, I'd like to move for introduction of the exhibits that we used on cross-examination of Dr. Teaf. I've collected them here at the podium.

THE COURT: Any objection?

MR. BULLOCK: I have no objection to the ones that we used today, Judge, because we saw those. I still haven't seen the ones which they used and referenced yesterday. I would like to see those before I agree to the admissibility of them.

THE COURT: Mr. George has a stack of them right here.

MR. BULLOCK: I think these are the ones that I saw today, Judge. And I don't have any objection to these.

THE COURT: All right. As to the ones there before me that were presented to you, those are admitted. As to the remainder, I'll leave it to counsel to get your heads together and present those for the Court. Mr. George.

CROSS-EXAMINATION

BY MR. GEORGE:

Q. Good morning, Dr. Fisher.

A. Good morning, sir.
Q. You and I have met before, have we not?
A. We have.
Q. It's a pleasure to speak to you again this morning. Sir, I want to follow up. One of the statements you made in your direct examination that in your opinion litter is disposal because it is not used for growing poultry. Do you recall saying that?
A. I don't necessarily recall saying that. I said that litter was not used for growing chickens. This is my testimony today, is that what you're referring to?
Q. Yes, sir, yes, sir.
A. I said litter was not used for growing chickens, that it was disposed in fields or to broadcast in fields to grow grass.
Q. Sir, is commercial fertilizer applied to a field being disposed?
A. It could be.
Q. If it's being applied for the purpose of increasing forage production, would you consider that disposal?
A. I would consider it disposal if a component of that fertilizer was in excess of the requirement of the crop being grown.
Q. You would look at commercial fertilizer on a component-by-component basis; correct?
A. Yes, I would.

Q. Are you aware of anyone else in terms of a regulatory scheme that looks at commercial fertilizers that way?
A. I think you would have to ask Dr. Johnson that question.
Q. Sir, you don't disagree, do you, that poultry farmers in

the Illinois River Watershed and cattle ranchers who make use of poultry litter are doing so to increase forage production?

A. To the extent that it's being applied within the agronomic needs of growing grass, no.

Q. You're not a specialist on agronomic needs of crops, are you?

A. You know, I'm starting to think I might just be after all these years.

Q. Well, are you an agronomist?

A. I am not.

Q. The State of Oklahoma has hired an agronomist in this case, a soil scientist, Mr. Johnson; is that correct?

A. They've hired Dr. Johnson, yes, they have.

Q. Let's look at the demonstrative exhibit that you testified from regarding photos taken of either litter transportation or storage or use in the Illinois River Watershed. You assembled this exhibit?

A. I did.

Q. Okay. And this is Demonstrative Exhibit 428. Now, if I understand your testimony, sir, you hired nine of Tulsa's finest to conduct surveillance of poultry growers, cattle

ranchers and farmers generally in the Illinois River Watershed; is that right?

A. I don't know if it was exactly nine, but it would not be far off the number.

Q. Okay. And those nine officers -- who I assume were working off-duty; is that right?

A. They were.

Q. Spent considerable time in the Illinois River Watershed

following around poultry litter trucks and taking photographs of litter application; correct?

A. They spent considerable time, more time looking at poultry facilities but they spent considerable time in the watershed.

Q. Now, this first photo that you showed, I think, was the only one that you mentioned Tyson. It's in the far right-hand corner as 5182. What's being shown there?

A. Okay. What's being shown -- in fact, I have the wrong exhibit is up in front of me on the screen if that's of any moment to you, Mr. George.

Q. It is. I'll correct that. Exhibit 429 on the screen, please. I'm sure that mistake was mine, not the talented people at the back of the room.

A. What we're observing in that frame, according to the notes and according to my observations of similar things is loading litter into a truck, a spreading truck.

Q. Anything improper or unlawful in your view about the

activities shown in that photograph?

A. I would not have an opinion on unlawfulness or improperness of that.

Q. In fact, with respect to all the photographs shown on Demonstrative Exhibit No. 429, are you aware of any instances in which that conduct is in violation of law?

A. I'm not specifically aware of any particular violations of law and nor would I really have an opinion on that.

Q. You are aware, are you not, sir, that both Oklahoma and Arkansas have rules and regulations that apply to individuals using poultry litter and storing poultry litter and hauling and transporting poultry litter?

A. We're talking about today?

Q. Yes, sir.
A. And we're not talking about the past?
Q. Well, let's talk about today first, then we'll talk about the past.
A. Okay. My knowledge is that there are rules regarding that in Oklahoma. And I believe, but do not have certain knowledge of what the Arkansas structure currently is.
Q. You're not aware whether or not Arkansas has rules that govern the land application of poultry litter and the transportation of poultry litter?
A. I guess you have to be more specific than that. There are rules with respect to the application of poultry litter in

certain watersheds in Arkansas today.
Q. Today is not the first day those rules have been in place in the State of Arkansas, is it?
A. With respect to amounts that can be applied, it's pretty recent regulation is my understanding.
Q. Who do you understand that from, sir?
A. Having worked with folks in this area since 1997.
Q. Are you aware, and if you're not just say so, that Arkansas passed laws regulating poultry litter back in 2004?
A. Oh, I'm aware of that. I'm talking about prior to 2004.
Q. Well, none of these photographs were taken prior to 2004, were they?
A. No.
Q. So, sir, with respect to all of the activity that you and the nine off-duty Tulsa police officers observed in your thousands of hours in the Illinois River Watershed, how many reports did you make to the regulatory bodies in Arkansas or

Oklahoma regarding unlawful activity?
A. From the Illinois River Watershed, none to my knowledge.
Q. Now, with respect to Exhibit 429 that's on the screen, a couple of these photographs show water. We talked about this one in the right-hand corner. And I believe your testimony was that that's the Illinois River Watershed in the background -- or the Illinois River in the background?
A. That's correct.

Q. Sir, how far is that litter truck from the river?
A. Okay. Well, in this photograph it's going to be foreshortened because it's done by telephoto, but that's going to be probably in excess of a hundred yards.
Q. Are you aware that the Arkansas regulations provide for setbacks from water bodies for land application areas?
A. I am.
Q. Okay. And you didn't report this as a violation to the Arkansas regulatory body, did you?
A. No.
Q. Sir, some of these other waters that are shown in the photograph, I think this is the same water body in Frame 435 and 436; is that correct?
A. That's correct.
Q. Are those public waters?
A. Well, it could be construed to be waters of the United States, but it's a farm pond.
Q. Farm pond, okay. Are you aware of any substantial recreation use occurring in that farm pond?
A. I wouldn't recommend one.
Q. Okay. Would you recommend swimming in farm ponds in general?

A. Not here.
Q. You would in the western part of the state, would that be a good idea, swimming in farm ponds.

A. I think you have to look at each farm pond.
Q. Have you conducted a farm pond analysis?
A. In this instance, I think I have conducted a farm pond analysis from looking at farm ponds and their setting and what takes place nearby. And I would not swim in a farm pond within this watershed.
Q. You've analyzed samples from farm ponds?
A. I've looked at farm ponds and know what happens in farm ponds. I don't need to analyze any samples to know what happens in a farm pond.
Q. All right. Let's move to the next series of photographs which is demonstrative -- they didn't label it for me.
MR. BULLOCK: They're on the back.
Q. (By Mr. George) Hey, 428. Sir, you've shown here in this series of photographs some piles of poultry litter; correct?
A. Yes.
Q. Okay. Do you know how long any of these piles were on the ground?
A. Any particular pile?
Q. Sure.
A. From that set of information, no. I think they were out there on the order of weeks. There's -- let me review the -- refresh my memory from the notes, if there's anything in there.
THE COURT: Top middle.
A. Yeah, the top middle diagram is indicated by Detectives

Hummel and Weatherly, that have been by this pile on a number of occasions, say that it's been in place for at least two weeks.

Q. (By Mr. George) Okay. Well, is this pile in Arkansas or Oklahoma?

A. It's in Arkansas.

Q. Are you aware that there is a rule in place, regulations in place in the State of Arkansas that prohibit any lengthy storage of poultry litter uncovered?

A. No.

Q. You're not aware of that?

A. No.

Q. Okay. You didn't bother to make a phone call to the Arkansas Natural Resources Department to ask them to send someone out to get that pile removed?

A. I did not.

Q. Why not?

A. Because, A, I was unaware of any regulation. And B, I would have reviewed that long after that pile was gone.

Q. Well, you thought this was important enough to take a photograph of; correct?

A. Well, my investigators thought it was important enough to take a photograph of and they did. And there were a number of other uncovered piles noted in Arkansas in their records.

Q. Do you have any reason to believe, sir, that if the State

of Oklahoma made a report to the State of Arkansas regarding an uncovered litter pile in the Illinois River Watershed, that that would not be addressed by the Arkansas Natural Resources Commission?

A. I have no idea whether it would be or would not be.
Q. You think the State of Arkansas might just thumb their nose at that?
A. I don't know what the State of Arkansas would do.
Q. Let's look at State's Demonstrative 427. You created this document?
A. Yes.
Q. And you've shown us the location by triangles of poultry houses in the Illinois River Watershed; is that correct?
A. That's correct.
Q. If I understand the graphic correctly, you've only shown on here those houses that from your ground truthing you determined were active poultry houses?
A. Well, actually there's less shown than that. What is shown on there are poultry houses that were identified as active in ground truthing and poultry houses for which we could specifically identify a related integrator.
Q. Okay. But all of the triangles shown on here and the breakout in the bottom right-hand corner are supposed to be active houses; correct?
A. Active houses for which we have an integrator, that's

correct.
Q. And the way you determined or verified that they were active in 2005 and 2006 was not just by looking at a satellite photograph, but actually sending someone out to determine that; correct?
A. Well, I need to correct that. It's not a satellite photograph, it's an air photo. It's a seven-tenths meter resolution air photo, so it's not a satellite photograph. What

is significant is the resolution anyway. So could you repeat your question now that I've forgotten what it was?

Q. Let me make sure I understand the distinction. The distinction is you flew around in a plane as opposed to looking from a satellite?

A. It was flown by an air photo contractor which is what they do for a living.

Q. Okay. Thank you, sir. The question was, do I understand correctly that each of these triangles shows an active poultry house for which you went out or someone on your behalf went out and determined from ground truthing at the time, 2005 to 2006, each of these were active?

A. Well, that's partially correct. I mean, it certainly went to every location that was visible from a public right-of-way to attempt to determine the active or inactive status of that house. But in addition, information provided by the defendants, including your clients, as well as information from

tax records which your clients were assessed fees for birds present in those houses, were also part of that assessment.

Q. Sir, you show how many active locations for Cal-Maine in 2005 and 2006?

A. Well, this is for this general point. We have that they are Cal-Maine and Willowbrook have relatively limited operations. They're shown on there. I think they would be generally thought of as active. I think Cal-Maine actually pulled out in '04.

Q. Okay. But your ground truthing was done in 2005 and 2006; correct?

A. Correct.

Q. But despite the fact that Cal-Maine, which you know

apparently, was not raising birds in the Illinois River Watershed in 2005, they show up on your map as active poultry house locations in 2005; correct?

A. Well, they show up as a Cal-Maine. I'm not sure they show up in the database as active, but they show up on the map as mapped.

Q. What's the title to the map, sir?

A. It says active poultry houses located in the Illinois River Watershed 2005, 2006.

Q. If I understand correctly, you're not now representing that all of these locations shown are really active in 2005, 2006?

A. Not with respect necessarily to Cal-Maine for the few houses that they have.

Q. Is Cal-Maine the only one that you made a mistake on?

A. I'm sure -- I'm sure there are errors in there. It's a really complicated task. But it represents -- I think it gives a true representation of active houses within the Illinois River Watershed.

Q. With regard to true representation, you selected a couple of photographs that I think are break-outs of particular poultry farming operations; is that right?

A. That's correct.

Q. Looks like you've got the Hat Creek Ranch and Green Country Complexes 1 through 3. Did I read that correctly?

A. That's correct.

Q. We've already demonstrated, the Judge has already demonstrated my math is not very strong, so my accounting may not be either.

THE COURT: I'm afraid you were right.

MR. GEORGE: I was going to give you that one, Judge.

THE COURT: No, sir.

Q. (By Mr. George) With respect to Green Country Complexes 1 through 3, how many barns are shown on that farm?

A. 30.

Q. 30 barns?

A. That's correct.

Q. Large farm; right?

A. That's quite large, yes.

Q. The Simmons Hat Creek Ranch, how many barns are shown on that farm?

A. I believe eight.

Q. Sir, are these two farms representative of the typical poultry farm located in the Illinois River Watershed?

A. Well, the Green Country operation is a large one. The Hat Creek Ranch is not that large, there are eight houses there. But there are a variety of types of poultry operations. I've not done a location analysis of this, that is what the average number of houses is per location.

Q. Sir, you've spent time in the watershed and you've observed a good number of poultry farms; correct?

A. Yes, I have.

Q. Do we have disagreement that a typical farm in the Illinois River Watershed would have on the order of three or four houses as opposed to eight or 30 houses?

A. I really have to do that analysis. I think there's certainly not an insubstantial number of farms that you would characterize like that.

Q. Is there any reason, sir, that you selected the larger

farms for your photographs?
A. Simply because in one case, it is a large farm. So that was easy to select and it stands out in the landscape as you

travel down Highway 59 in Oklahoma. And the other instance, it just happened to be the farm for which we had a record, time period of record of a pile sitting outside uncovered.
Q. Okay. You spoke in your direct testimony about land application of poultry litter from various farms in the Illinois River Watershed; is that correct?
A. That's correct.
Q. With respect to this large farm, the Green Country Farm - and this is just part of it; correct, there's more to it than this?
A. That's the -- it sort of depends on how you -- that's a facility that belongs to Green Country Farms.
Q. Green Country owns about a hundred houses in this watershed, don't they?
A. I've not made that count directly, but I wouldn't doubt you.
Q. Have you read the deposition of Steve Butler, the president of Green Country Farms?
A. I don't think I've read his deposition.
Q. Are you aware from whatever source, sir, that all of the poultry litter from Green Country Farms is exported from the watershed?
A. I'm aware that all of the poultry litter from some of the larger operations, including Green Country Farms, is exported and has been. I'm also aware that the total amount of export

that you can account for from BMPs is approximately 20 percent of the total we estimate to be generated.

Q. Since you mentioned it, what is the total amount that BMP shows as being exported from the watershed in terms of poultry litter last year?

A. Last year, I'm not sure I have a full record for last year. I believe that the claim is -- the claim, as I recall from reading expert materials provided by the defendants, was 70,000 tons. The prior year, it was about 56,000 tons in '06.

Q. So 70,000 tons in 2007?

A. That's my recollection. I would need to take a look at the records to get an accurate figure, but that wouldn't be wildly off the mark.

Q. Let's use that for discussion purposes because it's what we have, sir. So taking your 345,000 production number that you've shown on Demonstrative Exhibit 427, you have records confirming that approximately 70,000 of that was exported last year?

A. Well, I do not have the records, that misstates what I said. I said I have a partial record for what happened in 2007. I have a record of everything that happened in 2006. I have a statement from one of your experts that approximately 70,000 tons was exported last year. And until I see the data, you know, I can't confirm or deny that, but that's the number that's been put forward.

Q. Sir, let's talk about your opinions that you have drawn from your sediment core analysis. Do you recall that testimony?

A. Yes.

Q. And if I understood your testimony, it is your opinion, sir, that because in the sediment cores that you reviewed -- and let me stop there. How many sediment cores were collected?
A. I mean, there were four locations collected.
Q. Aren't there five locations collected?
A. There are actually six locations collected. At one location there was insufficient sediment to do an appropriate analysis. And in the uppermost portion of the lake, we were not able to bottom the core and that's an area that appeared to be disturbed. So those two cores were not looked at. The cores that were looked at were the cores near the dam, one near the dam, two at relatively constant intervals between the mid-lake and one in the upper part of the lake but not up in the riverine portion.
Q. And you performed chemical analysis on these five constituents that we heard you testify to on all of those cores?
A. We performed more than just those constituent analysis on all those cores, that's correct.
Q. Now, remind me what were the five that you focused on, in your opinion that they increased in a correlated fashion?

A. There were four.
Q. I'm sorry, thank you. What were those four?
A. Phosphorus, copper, zinc and arsenic.
Q. Sir, do the soils in the Illinois River Watershed contain phosphorus?
A. Sure.
Q. Naturally; correct?
A. A minor amount, yes.

Q. The soils in the Illinois River Watershed would naturally contain copper and zinc; correct?

A. They would contain some.

Q. The soils in the Illinois River Watershed would naturally contain arsenic; correct?

A. That's correct, they would contain some.

Q. Sir, has there been increased erosion in the Illinois River Watershed over the 50 years since the dam at Tenkiller was erected?

A. Yes, but increasing erosion would not change the concentration.

Q. It would not?

A. No. It might actually dilute it a bit since you would anticipate some of those materials would be more concentrated in surface materials. So with increasing erosion, there would be increasing dilution of that material.

Q. Sir, would cattle manure contain arsenic, copper, zinc and

phosphorus?

A. At levels nontoxic to cattle, one would hope. But I'd like to tell you this, everything in this room, you, me, the rug, the walls probably contains at some level phosphorus, zinc, copper and arsenic.

Q. That's right.

A. The issue is not whether they contain them, but whether they contain them at specific ratios that relate them back to a given substance, one; and two, whether or not they are correlated such that they indicate a constant source.

Q. Well, let's break that apart, sir, because I didn't hear anything in your direct examination about ratios of these constituents. Did you testify to that?

A. When we talk about correlation, we're talking about ratio.
Q. What I heard you testify to, sir, and perhaps I missed it, and, if so, I can be corrected, was that increases in the concentration of each of these four in a lock step fashion suggested to you a common source. That's what you testified to; correct?
A. It does.
Q. Now, where is your statistical analysis, sir, of the ratios of arsenic, copper, zinc and phosphorus to one another in those core sediments?
A. You have the underlying data, you can make your own analysis.

Q. Well, but you didn't provide a statistical analysis of that, did you?
A. Did I provide in my discovery documents, no?
Q. So as we sit here today, sir, can you point me to any piece of paper that's been provided to the defendants that would support this ratio between these constituents that you believe suggest poultry litter as a source?
A. Sure, the underlying data.
Q. But you didn't provide statistics related to that, you just provided the lab reports; correct?
A. No, I provided lab reports and a summary table relating sediment age to chemistry.
Q. Let's keep going with other sources. Would human waste, whether deposited into the watershed through septic tanks or point sources, contain arsenic, copper, zinc and phosphorus?
A. Sure.
Q. Have there been increases in the human population in the

watershed in the last 50 years?

A. There have. The human population has approximately tripled.

Q. Sir, have you submitted your sediment core analysis and your belief that the increase in a common fashion over time suggests poultry litter is a common source to any journal for consideration for publication?

A. Not yet.

Q. Have you had that opinion peer reviewed in any way?

A. No.

Q. Are you aware, sir, as someone who has studied the scientific literature related to poultry litter and potential water quality impacts, of any other scientist in the world who has taken the approach that you have taken regarding sediment cores and phosphorus, arsenic, copper and zinc and suggested that poultry litter is a source because of analysis of those cores?

A. Yes.

Q. Point me to that article, please.

A. Me. There's an article published, USGS Water Resources Investigations, more recently through OSU in which I did a similar analysis for Eucha-Spavinaw. So not another scientist, but I think if you talk to any other geochemist, they would be able to support that.

Q. Did you offer an opinion in this USGS article that poultry litter was the source?

A. I believe I did.

Q. Okay. If I go pull that article, I'll find a statement from Bert Fisher that says poultry litter is the source based upon my review of the chemical analysis of these cores?

A. I believe you will.
Q. Okay.
A. I have to look at it myself to be sure, but I believe you

will.
Q. What was the date of that publication?
A. That would have been last year.
Q. Published by USGS?
A. Well, it's published out of OSU. It may be in my -- oh. It's not in my CV. I can get that to you. It's published through the Water Resources Institute at OSU.
Q. I'm sorry, sir, could you say that again?
A. I'm sorry, it's published through the Water Resources Institute at Oklahoma State University.
Q. Who were you working for in that study?
A. That was a research study. I was working at the University of Tulsa.
Q. Were you also a retained expert at that time for the City of Tulsa in litigation?
A. No.
Q. You were not?
A. No, not a retained expert in litigation. No, I don't believe so.
Q. Dr. Fisher, you have a long history with the private attorneys representing the attorney general in this case, do you not?
A. I do.
Q. Your consulting firm currently shares office space with David Page; is that correct?

A. It does not.
Q. When did you change that?
A. About a month ago, I think.
Q. After your deposition?
A. No, it was actually nearly simultaneous with my deposition.
Q. Until a month ago, were you sharing office space with David Page?
A. I was.
Q. How long did you share office space with David Page?
A. I think dates may be a little furry here, but sort of late last spring or early last summer through the end of January of this year.
Q. Okay. So eight or nine months?
A. Yes, be about right.
Q. Before you moved in offices with Mr. Page, you'd been sharing offices for approximately four years with Randy Miller of the Miller, Keffer, Bullock firm; is that correct?
A. No, that's not correct. I was sharing offices with Randy Miller at the Miller, Keffer & Bullock. I started officing there in 2004 and it was late August or early September, and then left there in -- when I moved into the new offices. So that would have been less than three years.
Q. Okay. You do understand, do you not, sir, that Mr. Miller is one of the attorneys that has represented the attorney

general's office in this case?
A. I understand Mr. Miller has represented the attorney general's office.
Q. Sir, before you formed your current consulting firm which

is Lithochimeia; is that correct?
A. That's correct.
Q. You worked in-house for four years with the law firm of Gardere & Wynne here in Tulsa; is that correct?
A. Not immediately. I worked for Exponent for four years. And prior to joining Exponent as a principal here in Tulsa, I worked in-house as a consultant for Gardere & Wynne.
Q. Let me back up for a moment. I want to make sure I understand your current situation. Until a month ago during the pendency of this lawsuit, you were office sharing with the attorneys representing the attorney general's office; is that correct?
A. That's correct.
Q. Now, with respect to Gardere & Wynne, how long did you work in their in-house department?
A. I was there from 1995, fall of '95, through July, I think, July or August of 2000.
Q. So around five years; correct?
A. However that math works. I understand that's not your strong suit either.
Q. Thank you, sir. Dr. Fisher, David Page and Randy Miller

were your supervisors at Gardere & Wynne, were they not?
A. Well, I certainly provided work product under their direction there, yes.
Q. Worked closely with them on litigated matters?
A. Yes.
Q. So if I understand correctly, for at least nine out of the last 15 years you've been working for or sharing office space with either Randy Miller or David Page; is that right?

A. That's accurate.
Q. You've counted on Mr. Miller and Mr. Page to keep your firm busy over the past decade, have you not?
A. No.
Q. They haven't sent you considerable work?
A. No, I think you've mischaracterized that. I certainly have had work from -- with respect to this matter. And I've had other work from Mr. Page but it's not my firm. When I worked for Gardere & Wynne, they certainly kept me busy but I was an employee for them. When I had my stint with Exponent, I don't really recollect any work I did for Mr. Miller and Mr. Page during that period.
Q. While you were with another firm at Exponent?
A. Correct.
Q. Sir, your firm, Lithochimeia, has been paid over a half a million dollars by the law firms representing the attorney general in this case; is that correct?

A. Sure has.
Q. Let's go to State's Demonstrative Exhibit 430. Sir, this was the series of graphs and diagrams that you testified to at length in your direct; correct?
A. Yes.
Q. Now, sir, with respect to this picture in the right-hand column that shows a layer of -- is this soil that's pink?
A. That's unsaturated material. That could be soil or rock.
Q. It appears to show water beneath it; correct?
A. That's correct.
Q. Is this an attempt by you to represent the typical conditions of the Illinois River Watershed in terms of soil depth and proximity to groundwater?

A. No. It's an attempt by Dr. Imes from the USGS. As it says in the title, it's a schematic diagrams of surface and groundwater change mechanisms in the Ozark Plateau's Province which is after Imes 1994. The only modification that's been made to his diagram has been to color it and to move the lines indicating evapotranspiration to horizontal from slanted.

Q. Can you tell me the depth of the soil material that's reflected in that diagram?

A. Well, that particular diagram does not indicate soil. It's a schematic diagram, there's no scale to it.

Q. Right. Well, with respect to the Illinois River Watershed in reality, what are the average depths of soil?

A. Well, it certainly depends on how you define soil. I mean, soil can be quite thick in alluvial fills and it can be fairly thin on hilltops. Plus if you take a look at the -- when you begin to drive any sort of sampling device into pastures there, you'll reach -- you can reach refusal within just a few inches. So what's described as soil really is regolith, it's rock, rocky, cherty material.

Q. How far do you have to -- how deep do you have to go before you hit groundwater?

A. Well, that's variable as well. Groundwater in alluvial fill is going to be defined basically by the surface of the stream. If you're on a plateau or a hillock, you may have to go down 60, 80 feet to hit groundwater, maybe more.

Q. Do you agree there's considerable variation in the Illinois River Watershed in terms of the depth of surface material before you get to groundwater?

A. There is.

Q. There's also considerable variation in the Illinois River Watershed in terms of whether fields are on top of fractures or fissures; correct?

A. I think in terms of whether or not they're on mapped fractures or fissures, that would be accurate. But given the nature of the geology here, I would be pretty confident that I could find a fracture or a fissure underlying most pastures.

Q. Sir, can you say that poultry litter is always applied on

soils that are inadequate to filter out bacteria from water before it reaches groundwater?

A. No, of course not. I mean, you can never make an absolute statement of that nature. If you're applying karst terrains, just as recognized by your own expert, Dr. Andrews, karst terrains are high-risk terrains for polluting groundwater. And all the examples that he provides in his report concerning contamination of rural wells indicate that when you're in a karst terrain, it can be very contaminated and the degree of contamination varies with animal operations. If you are over 50 or 60 percent of wells or groundwater samples are contaminated with bacteria, those are uniformly, from the citations Dr. Andrews makes, uniformly from areas with intensive animal agriculture and animal waste disposal at the surface.

Q. You're testifying about what Dr. Andrews' opinions are?

A. I happened to read his report, it's pretty easy to testify. His opinions actually are pretty close to mine.

Q. I suspect Dr. Andrews will take the stand and testify. Dr. Fisher, you told the Court that the karst terrain of the Illinois River Watershed and this topography and geological features have been apparent to geologists and to laypeople

since the beginning of time?
A. I said that they --
MR. GARREN: Object to the form.

A. -- would be apparent to the first geologist who had walked through there. I made no statement -- you mischaracterized my statement.
Q. When did the first geologist walk through there?
A. Well, I don't know but it was prior to 1960.
Q. It's no surprise, is it, sir, that the Illinois River Watershed is karst topography, that's been known for decades; correct?
A. That's correct.
Q. Been published and discussed and written about in the literature, both from Arkansas and Oklahoma and other places; correct?
A. That's correct.
Q. Sir, given that fact, do you have any explanation for why the State of Oklahoma has permitted the land application of poultry litter in the Illinois River Watershed?
A. I don't have an opinion concerning decisions made by state agencies.
THE COURT: Mr. George, the Chief Judge has scheduled a judges meeting today at noon. And in that I am the most freshman of the judges, I need to attend. We'll be in recess until 1:15.
(Recess.)
THE COURT: Mr. George, you may resume your inquiry.
MR. BULLOCK: Judge, a little housekeeping matter just

to address the Court on schedules so everybody thinks -- knows what we're thinking in terms of schedule.

THE COURT: Yes, sir.

MR. BULLOCK: Is that we had originally planned to end our examination on the third day a couple of hours early.

THE COURT: Yes, sir.

MR. BULLOCK: Yesterday you said that the time started, I think, about 11:15.

THE COURT: Yes, sir.

MR. BULLOCK: Our current schedule would be that we will end our case about 5:00 o'clock on Thursday. That would reserve approximately two hours for Dr. Lawrence who has, according to an agreement with the parties, has to be called out of time.

THE COURT: And he will be -- he will come on when?

MR. BULLOCK: Monday morning. When exactly was the agreement?

MR. GEORGE: Monday I think was the agreement, but does the two hours include cross or just direct?

MR. BULLOCK: Actually that is direct and cross for Dr. Lawrence.

THE COURT: Would we then utilize Friday?

MR. BULLOCK: Yes, the defendants have given us a list of witnesses to call on Friday.

THE COURT: All right, thank you.

MR. GEORGE: We'll start putting our case on on Friday that we discussed with Plaintiffs' counsel.

MR. TUCKER: On the issue that we discussed earlier, Your Honor, about exhibits.

THE COURT: Yes, sir.

MR. TUCKER: An exhibit that was used with Dr. Teaf, the parties I don't think have any objection to it. It is identified by the plaintiff as Teaf 6486. Because that is a catch-all number that applies to several hundreds or more of e-mails, I'm going to identify the pages that we used for the record.

THE COURT: Yes, sir.

MR. TUCKER: 6486-001, 002, 009, 012, 108 and 188.

MR. BULLOCK: No objection.

THE COURT: Thank you very much, those pages are admitted. In the interest of full disclosure, my colleagues noticed that I was eating a turkey sandwich at lunch and accused me of trying to manufacture grounds for recusal. You may resume.

MR. RYAN: In the same interest, I was trying to do a little housekeeping. We used the following exhibits during cross-examine of Secretary Tolbert. Can I read those into the record and move their admittance?

THE COURT: Please, if you would.

MR. BULLOCK: We have never received or they haven't

provided us with copies of those. We'd like to see copies of those the same as we asked --

MR. RYAN: All but two of them are on their exhibit list.

MR. BULLOCK: Those which were on our -- which we used with Secretary Tolbert, of course, but.

MR. RYAN: Well, you didn't use them -- they didn't use them, Your Honor, but they're on -- I believe they're on

their exhibit lists, all these TMDL stuff. If they're not, then we'll do it another time.

THE COURT: If they're their exhibits, we'll admit them, I take it; correct?

MR. BULLOCK: Yes.

THE COURT: As to the other ones, if we could just give Mr. Bullock a courtesy to look at them to make sure --

MR. RYAN: Well, one was a demonstrative aid, Your Honor. It was our board that was up here. Just 91 is the only one -- 91 and 185 are the only ones that fall in that category.

THE COURT: 91 and 185?

MR. RYAN: I will get a copy to Mr. Bullock on those two and we'll take it up another time.

THE COURT: I doubt if there's going to be a problem.

MR. RYAN: I understand. The others are Defendants' Exhibit 25, 183, 72, 68, 77, 74.

MR. EDMONDSON: Slow down, please. I'm sorry, Your

Honor.

THE COURT: That's fine. Those are Plaintiffs' Exhibits rather than --

MR. RYAN: These are Defendants' numbers.

THE COURT: All right.

MR. RYAN: I'll start again.

THE COURT: Please.

MR. RYAN: 72, 68, 77, 74, 73, 76, 75, Demonstrative 25 or Exhibit 25. And if they have an objection, Your Honor, about any of the ones I moved into admission, you can looking at them tonight and let me know and we'll take it up with Your Honor.

MR. BULLOCK: On your Defendants' Exhibits, could you

provide those for us?

MR. RYAN: Your Honor, we already have provided them. You want us to provide them again?

MR. BULLOCK: I would appreciate the courtesy.

MR. GEORGE: They're in the binders but, Your Honor, we'll get them copies.

THE COURT: Well, of course, the difficulty is that there are six banker's boxes here of documents to the right of me. And in order to give opposing counsel a reasonable opportunity to object, we probably need to provide them courtesy copies. I don't know how you-all are set up in terms of electronic access. Apparently the young lady over here,

she's obviously very adept at pulling them up, but I don't know in terms of plaintiffs' access. I assume from Mr. Bullock's statements that your access is not that readily --

MR. BULLOCK: It truly, it's rather clumsy over here to get access to those.

MR. RYAN: Your Honor, do want the record to be clear that all of these exhibits have been furnished to plaintiffs.

THE COURT: I understand.

MR. RYAN: Now, I understand the Court's suggestion and we will, of course, get them copies again, but I don't want the record to reflect that the plaintiffs have not been provided all of these exhibits.

THE COURT: I fully understand that. Thank you.

Mr. George.

MR. GEORGE: Thank you, Your Honor.

Q. (By Mr. George) Mr. Fisher, welcome back after lunch. I have a few additional questions, sir. Let me go back to your

sediment core analysis. And I believe you testified that cattle, in your opinion, cannot be the source or the explanation for the increasing concentrations of phosphorus, arsenic, copper and zinc in the sediment cores because cattle just recycle those constituents. Did I understand your testimony?

A. That's one of the reasons.

Q. Sir, with respect to the constituent at issue in this

motion, bacteria, do cattle recycle back?

A. No, cattle will produce bacteria or excrete bacteria.

Q. So every day in the watershed cattle are introducing new bacteria into the watershed; correct?

A. Cattle are defecating within the watershed, that's correct.

Q. And as the number of cattle increase over time, one would expect the number of bacteria from cattle to increase over time; correct?

A. Well, if that were true, that would be accurate, although the level of cattle has roughly doubled and stayed fairly stable for about the last 25, 30 years.

Q. Sir, did you track changes in bacteria concentration in your sediment cores?

A. No.

Q. In fact, you didn't analyze those sediment cores for bacteria at all, did you?

A. I did not.

Q. I want to go back to what I understand to be one of your baseline opinions and that is that the karst geology in the Illinois River Watershed renders more susceptible to groundwater to surface source contamination; have I stated your

opinion?
A. Okay. I'll state the opinion.
Q. Please do.

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A. The presence of karst, karsted bedrock within the Illinois River Watershed make it more susceptible to surface contamination, surface contamination reaching groundwater.
Q. Now, the karst terrain or topography or geology -- I'm not sure what is the appropriate term -- that you are referring to is not limited to Oklahoma, is it?
A. No, sir.
Q. It extends into Arkansas and into Missouri as well; is that right?
A. It does.
Q. Are you aware, sir, that your exact hypothesis, that the land application of poultry litter in karst geology contaminates groundwater with fecal coliform bacteria, was studied by researchers in southwest Missouri?
A. I'm aware of work done in southwest Missouri along those lines.
Q. Bring up Defendants' Exhibit 13. This is actually an exhibit that was used in your deposition, Mr. Fisher. It came from your materials. I'll hand you the pages.
A. Yeah, please do. I can't read the screen.
Q. It's not a complete copy, just pages that I want to draw attention to. Sir, do you see from the title of this article that what is being studied is the groundwater quality effects of poultry animal feeding operations?
A. Okay. You are referring to the abstract?

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Q. The title.
A. The title?
Q. Yes, sir. Do you see groundwater?
A. Yes, sir.
Q. Do you see poultry confined animal feeding operations?
A. Yes.
Q. Do you see the reference to the Upper Shoal Creek Basin in southwest Missouri?
A. I do.
Q. If you look in the first paragraph, sir, on the screen it's highlighted. I'm not sure that it's highlighted on your copy. Could you read the two sentences that are highlighted in the first paragraph?
A. Certainly. It says, "Most of the land use in the basin is agricultural with cattle and hay production dominating. The number of poultry CAFOs has increased in recent years. Poultry waste litter is used as a source of nutrients on pastureland as much as several miles away from poultry barns."
Q. You'll agree that in this study, the study area has some resemblance in terms of land use to the Illinois River Watershed. It's intensive in poultry production and it has cattle and hay production as well; correct?
A. I'd say -- well, that description would make it appear similar.
Q. Sir, do you see in the next paragraph that the researchers

in this particular study actually sampled what they refer to as P wells that were locations in close proximity where poultry litter had been applied. Do you see that reference in the second paragraph?

A. Yes.
Q. Then you see a little further down the reference to AG wells, which were areas that may be used for agriculture but they had no history of poultry litter application?
A. Yes.
Q. Can you read the conclusions of this study? It's highlighted on the screen in the third paragraph down.
A. Okay. Well, it's in their abstract, it's not necessarily their conclusion.
Q. Okay.
A. It states in the final paragraph, first sentence of the abstract's first column, "The results of this study do not indicate that poultry CAFOs are affecting the shallow groundwater in the Upper Shoal Creek Basin with respect to nutrient concentrations and fecal bacteria densities."
Q. Now, sir, in this particular study, it appears to me that they set up some what I would call control sampling. They were testing the impacts of poultry, so they sampled in some areas where they thought poultry impacts might be found and then they sampled in some control areas. Are you familiar with that concept?

A. I'm certainly familiar with controlled studies. This is a class study. They are setting up areas that they're sampling with and without some feature.
Q. Sir, you were involved in the groundwater testing, both setting up the protocol and reviewing the data conducted by CDM; is that right?
A. That's correct.
Q. Was there control testing done?

A. Well, the attempt was made to -- generally in groundwater investigations, you sample what you can. And that the original design of that experiment or that sampling was to have wells at variable distances from poultry houses on the theory that poultry waste is nearby to poultry houses. But in the end you have to have landowner approval or have a court order to get on to sample particular wells. So the attempt was certainly made to do that, but you generally end up sampling what you can.

Q. Sir, is it not true that the State made no attempt to select areas that were free from poultry litter applications and compare groundwater, fecal coliform levels from those areas with the places you had selected in reference to land application of poultry litter?

A. I would say that that's absolutely not true.

Q. You believe you've done some control testing in areas that are not impacted by poultry?

A. No, your question was the State made no attempt to do

that. I need to review the data again to be sure that your second -- that your assumption is correct. But the State certainly did make an attempt in that I made an attempt, along with personnel from CDM, to locate wells that were at distances from poultry houses.

Q. Were you successful in identifying wells that are representative of areas not impacted by land application of poultry?

A. We don't know.

Q. You don't know?

A. No, it appears that there seems to be contamination in many places even in areas we thought might not be impacted.

Q. So you cannot provide to the Court a comparative analysis

from the groundwater sampling done in this case of groundwater wells, fecal coliform levels unimpacted by poultry and those impacted by poultry?

A. I'm not sure that's an accurate characterization, but as I sit here, I couldn't provide you with that analysis.

Q. Well, if you were sitting at your office, could you now because I'm a little confused?

A. Well, if I went back to my office to think about that for awhile, I probably could.

Q. You don't have anything to offer on that subject today?

A. No, I do not.

Q. Let's go to your groundwater well sampling. In 2006, sir,

the State and its consultants sampled 41 residential wells in rural northeast Oklahoma; is that right?

A. I think that's roughly correct.

Q. Okay. And I believe I recall from your deposition that 2006 was the most comprehensive year of groundwater sampling under the State's sampling protocol; is that correct?

A. I think that's right. I think there was an additional 20 wells or so sampled subsequently.

Q. With the opinions that you've offered in this case, sir, you are relying upon the 2006 well sampling; is that right?

A. At least that was in the materials provided to me along with all the data that was provided.

Q. Are you relying upon wells that were sampled outside of 2006?

A. Well, since I have knowledge of them, I'm sure I relied upon that information.

Q. Play deposition -- hang on a second. You do recall giving

a deposition in this case, do you not, sir?

A. I do.

Q. Do you recall being asked the foundation for your opinions?

A. I do.

MR. GEORGE: Can we go to page 105 of Mr. Fisher's deposition, lines 4 through 14 and then page 106, lines 3 through 14?

(An excerpt of the videotaped deposition of Berton Fisher was played.)

Q. "Dr. Fisher, does Exhibit No. 6 reflect all of the well sampling analysis that you consulted as part of your analysis in the case?

A. "And these are from 2006 which was the year in which we had a comprehensive set of groundwater well samples. I believe that's what these are.

Q. "Let me ask the question more specifically then. Does Exhibit No. 6, to the best of your knowledge, sir, reflect all of the locations at which groundwater wells were sampled in 2006?

A. "Okay. To the best of my recollection, yes.

Q. "Okay. Were there wells sampled in 2006 -- I'm sorry, in 2007 for bacteria?

A. "I believe there were.

Q. "Okay. And have you produced the results of those lab analysis as part of your production in this case?

A. "I have not.

Q. "Have you reviewed and relied upon the results of well samples taken in 2007 as a foundation for any of the opinions that you intend to offer in support of your preliminary

injunction motion?
A. "I don't believe so."
(Videotape stopped.)

Q. (By Mr. George) Mr. Fisher, let's stick with 2006 -- and can you blow that up any larger?
A. Well, I'd just like to make the record reflect that I have yet to file an errata sheet on this deposition which is due by the 23rd, I believe.
Q. You know what an errata sheet is?
A. Yes.
Q. Mr. Fisher, do you see the exhibit that is in front of you that was also the exhibit referenced in the passage of the deposition that we just read?
A. I do.
Q. You recall this from your exhibit, do you not -- I'm sorry, from your deposition?
A. I do.
Q. In fact, you created this map; is that right?
A. I did.
Q. It's very hard to read the fine print on the boxes, but can you describe generally what this map was intended to show?
A. It's intended to show the numerical results of bacterial analytical data from groundwater samples within groundwater wells in Oklahoma from 2006.
Q. That one might be a little clearer.
MR. GEORGE: Your Honor, I have one other copy that might be more legible. I won't promise it, but to the extent it's helpful to the Court, I want to provide it.

THE COURT: Thank you, sir.

Q. (By Mr. George) Do you recall, Mr. Fisher, the exercise we went through in your deposition where I asked you to mark the wells on your exhibit where you had detected fecal coliform bacteria above the detection limit?

A. Yes.

Q. And do you see the X's on this chart?

A. I do.

Q. And do you recall these are the only ones that you could identify from the 41 sampled in 2006 where you found any fecal coliform bacteria?

A. Yes.

Q. And if you want to count them again, you can, but I'll represent to you that 9 out of the 41 tested positive for fecal coliform. Is that consistent with your memory?

A. Yeah, I think that's -- well, let's see.

Q. Count them, if you like.

A. I think that's generally consistent, about 20 percent.

Q. Dr. Fisher, in 2006, the most comprehensive year of the State's well sampling program, you sampled 41 wells, and in those 41 wells you could detect no fecal coliform bacteria in 32; correct?

A. Yes.

Q. Sir, did your investigation of residential wells turn up a single residential well where Campylobacter was detected?

A. No.

Q. Isn't it true, sir, that the scientists working for the lawyers retained by the attorney general in this case decided against testing wells for the presence of Campylobacter at some

point because they had been unable to regularly detect it?
A. Yes, I think that's accurate, but the -- but it mischaracterizes the reason for not sampling. I think the reason for not sampling was it couldn't be detected and would be -- the methodology was thought not to be working very well.
Q. All right.
A. So then we suspended operations.
Q. So was the State's sampling program ill designed?
A. No.
Q. Sir, how many wells in 2006 turned up positive for Salmonella?
A. I don't believe any, but I have to refer to my notes. I don't think any did.
Q. I'll refer you to a demonstrative that was used yesterday, hopefully it's still here. The one with the residential wells. I don't have the number for you, I apologize. It's the one that showed all the groundwater that sampled positive.
MR. GEORGE: It's a good thing I'm surrounded by people, Your Honor.
Q. (By Mr. George) You recall this exhibit that was presented by Dr. Teaf yesterday, Mr. Fisher?

A. I believe I saw that this morning. I do recall this exhibit.
Q. My understanding is this is the locations where groundwater was sampled. Is that what you understand?
A. Yes, that's correct.
Q. Sir, many of the locations reflected on this map are places where samples were collected by geoprobe; correct?
A. Yeah, there are geoprobe samples on here.

Q. In fact, all of those -- those locations would be prefixed with GP; is that right?
A. That's correct, they're the black triangles.
Q. And this particular demonstrative is intended to show there was a detection of bacteria even if it was just total coliforms in some of those geoprobe samples. Can you explain the geoprobe process for the Court, please?
A. Geoprobe is a device that advances a probe by pushing it hydraulically into unconsolidated material. It then has the ability -- would have an internal screen and then to the exterior portion of the geoprobe may be pulled up to expose that screen and capture fluids that are intercepted by the geoprobe at that depth.
Q. Are there some limitations on the depth at which a geoprobe can secure a sample of water?
A. Well, the limitation is not necessarily directly as to depth. The limitation -- that would be the length of your

ability to push. The depth of penetration would be the point of refusal which would be the intercepting rock that's competent enough to no longer permit the geoprobe to advance by hydraulic pushing.
Q. You reviewed the geoprobe work and data in this case; is that correct?
A. I've looked at that data, yes.
Q. Sir, can you give us the typical range at which water was collected using the geoprobe device?
A. Shallow.
Q. Define that, please.
A. Okay. Probably less than 20 feet in most cases.
Q. Sir, what is the average depths of the shallow wells --

you used that term in your affidavit -- in northeast Oklahoma that are being used by residents for consumption of drinking water?

A. Well, the criteria for looking at shallow wells, I don't know what the average depth of shallow wells is, but the wells that were selected for sampling would be those that would largely be completed within the Boone and/or the underlying Saint Joe, so around 150 feet total depth.

Q. Sir, are you aware of a single well in northeast Oklahoma that is completed to a depth of less than 20 feet?

A. I am not personally aware. That would, in all likelihood, be a dug well and be quite old.

Q. People in northeastern Oklahoma are not relying upon wells that are completed to a depth of 25 to 30 feet, are they, for drinking water?

A. Typically not.

Q. You agree with me, do you not, sir, that samples collected through the State's geoprobe process are not representative of water actually being consumed by northeast Oklahomans?

A. One would hope that they are not representative of water being consistently consumed by people in northeast Oklahoma.

Q. Do you recall getting that same question in your deposition?

A. No, I don't, but I'm sure you can play the tape and see.

MR. GEORGE: Let's go to page 129, lines 19 through 23.

(An excerpt of the videotaped deposition of Berton Fisher was played.)

Q. "Is it your testimony, sir, in this case that the values

reflected in geoprobe sampling are reflective of what northeast Oklahomans are actually consuming from their residential wells?

A. "No."

(Videotape stopped.)

Q. (By Mr. George) You haven't changed your position on that, have you, sir?

A. No.

Q. Sir, you are a geologist; correct?

A. That's correct.

Q. You worked on, as I heard your description of experience, groundwater cases involving petrochemical and petroleum products; correct?

A. Yes, and salt.

Q. Sir, prior to being retained by the attorneys representing the attorney general's office in this case, had you ever worked on another case in which the constituent of concern was bacteria?

A. Yes.

Q. Do you recall getting that question in your deposition?

A. Yeah, I did, and I need to amend that because I have --

Q. Let's look at what you said, then we'll give you a chance to amend it.

MR. GEORGE: Will you play the clip beginning at page 11, lines 13 through 16?

(An excerpt of the videotaped deposition of Berton Fisher was played.)

Q. "Sir, can you identify for me the cases that you've worked on in litigated matters where the constituent of concern was bacteria?

A. "There are no such cases."

(Videotape stopped.)
Q. (By Mr. George) Sir, is it your testimony today that there are such cases?

A. Yes, there is. And the reason that I just didn't recall at the time -- the Wise County cases involved bacterial growth producing hydrogen sulfide in residential wells as a consequence of the introduction of natural gas and condensate. So I didn't think about them as coming from the surface, but the contaminant of concern was hydrogen sulfide is microbially produced.
Q. Sir, you were not asked to evaluate in that case the fate and transport of bacteria found in groundwater, were you?
A. No.
Q. You were simply evaluating the effects of groundwater -- I'm sorry, of bacteria found in certain wells?
A. That's correct.
Q. So as it stands today, sir, you have never before worked on a litigated matter in which you were asked to offer an opinion as to the fate and transport of bacteria to groundwater?
A. That's correct.
Q. Sir, prior to being retained by the Plaintiffs' lawyers representing the attorney general's office in this case, had you ever worked on a research project or published a paper related to the movement of bacteria in either surface water or groundwater?
A. No.
Q. Sir, have you ever had your opinions in an environmental

case excluded or limited by an Oklahoma court?
A. By an Oklahoma court, no. I believe there was an instance before Judge Frizzell in which groundwater opinions were excluded as to the specifics of a property as opposed to the county in general, a region in general.
Q. I was too narrow in my question, I suspect. You have had your opinions excluded or limited in an Oklahoma federal court; correct?
A. In terms of expression of them, yes.
Q. Dr. Fisher, I want to make sure that I've followed the right case. Are you referring to the case of Quarles vs. The United States?
A. Yes, I am.
THE COURT: Just for the record, the basic reason why that was excluded is it came too late.
MR. GEORGE: I've only read the hearing transcript, Your Honor, and I don't know all the details but wanted to get it out.
THE COURT: Just it came after the deadline.
MR. GEORGE: Okay, thank you. Can I confer with counsel for just a moment, Your Honor?
THE COURT: Yes.
MR. GEORGE: I'll pass the witness.
THE COURT: Mr. Garren.
MR. GARREN: Thank you, Your Honor.

REDIRECT EXAMINATION
BY MR. GARREN:
Q. Dr. Fisher, one of the last questions posed to you had to do with your lack of experience in testifying with regard to

fate and transport of bacteria. Do you remember that?
A. That question, yes.
Q. And tell me, sir, isn't it true that bacteria can attach to other particles?
A. Yes.
Q. And in fact, you are familiar with and have testified and are certainly competent in knowing particles -- knowing the fate and transport of particles, do you not?
A. Yes, I've testified in two erosion cases.
Q. So to the extent that bacteria would be attached to particles and it can, in fact, flow through as you've testified here today, you might expect to find bacteria where those particles flow?
MR. GEORGE: Your Honor, objection, leading.
THE COURT: Sustained. Rephrase.
Q. (By Mr. Garren) If -- you've testified that bacteria can attach to particles, have you not?
A. Yes.
Q. And you've testified, as I understand it earlier today, that particles --
MR. GEORGE: Same objection, Your Honor, leading.

THE COURT: Rephrase.
Q. (By Mr. Garren) With regard to the transport of particles, where do they go in a karst geology as we've seen here in the IRW?
A. They go to the same place the water does. They go through the cracks, crevices and fissures.
Q. And if bacteria is attached to those particles, would they go with them?

A. They would.
Q. With regard to this article in the southwest Missouri area, have you had a chance to look at that?
A. Not recently.
MR. GARREN: May I approach, Your Honor.
THE COURT: Yes, sir.
Q. (By Mr. Garren) Let me hand you a copy of that document. This document says in the second paragraph, it identifies P wells as wells being tested, do you see that? I believe you testified something about that.
A. Yes.
Q. Looking over on the second page of this document at the very top can you read the very first full sentence starting with fecal streptococcus?
A. Fecal streptococcus bacteria were detected in 8 of 25 P1 samples and 6 of 15 AG1 samples.
Q. So water wells near poultry barns did, in fact, have an 8

of 25 incidence of finding fecal streptococcus in this report. Is that how you read that?
A. Yes.
Q. And down further in that paragraph underneath where it says introduction, can you see where it talks about the production of 33 million chickens being referenced as part of this report?
A. Yes.
Q. How does that compare with the chicken numbers that we find in the IRW?
A. That's substantially smaller.
Q. In fact, we looked earlier today -- if we look just at the Green Country barns that we see 30 barns there. Do you see

those? Do you know how many average broilers are contained in a single barn at a single time?

A. Yeah, the average number in a modern barn per time is around 25,000, 20 to 25,000 birds.

Q. And I'll ask you maybe to help on the math. We've got 30 barns times 25,000; correct?

A. Yeah, that's three-quarters of a million birds roughly.

Q. And that's one flock, isn't it?

A. That's correct.

Q. And they do how many flocks a year in one of those complexes?

A. On average, five to six depending.

Q. And that's just one complex -- or one of three complexes; is that correct?

A. That's correct.

Q. Do you know how many complexes Green Country Farms operate in the watershed?

A. I think, I reviewed that over lunch, I think they operate 16 complexes.

Q. And there's approximately how many barns in each complex?

A. Roughly ten. My recollection, having looked quickly at the data, is there is somewhere between 150 and 160 houses. I didn't look at their exact inventory of birds they could hold at any one time.

Q. So with regard to our entire watershed, the comparison that Mr. George is trying to draw from this article and this study in southwest --

MR. GEORGE: Objection, Your Honor, leading.

THE COURT: Sustained. Rephrase.

Q. (By Mr. Garren) Do you have an opinion about with regard to the size of the chicken population as reported in this article with what we are observing in the IRW?

A. Yeah, this chicken population is around one-fifth, about 20 percent of what we would see in the Illinois River Watershed.

Q. Also on the very first page of this document looks like the first, second sentence in the very first paragraph under

abstract where it says, "Most of the land used." Do you see that sentence?

A. Yes, I do.

Q. Can you read that sentence to the Court, please?

A. It says, "Most of the land use in the basin is agricultural with cattle and hay production dominating."

Q. Do you find that to be consistent with what you observed in the IRW?

A. Well, yeah, most of the land use in the IRW, the open space use, there's sort of an almost a 50-50 mix. I've forgotten the numbers. But we have a lot of open space in the IRW that's used for pasture and hay production, but then there's a substantial number of poultry facilities present within the IRW.

Q. Is your opinion that the cattle and hay production is dominating in the IRW?

MR. GEORGE: Objection, leading.

THE COURT: Sustained, rephrase.

Q. (By Mr. Garren) What is your opinion about what dominates in IRW as compared to this study?

A. Well, the problem is this is talking about land use. And in terms of land use, the land use profile is similar between

this and the Illinois River Watershed. The difference appears to be that the number of poultry being produced, although the paper says it's increased in recent years, is much, much

smaller than in the Illinois River Watershed. And again, just now being hit with a paper you hadn't read in awhile, you really have to read these in detail before you can make judgments concerning it.

Q. Approximately how many poultry houses are there in the IRW?

A. Well, probably a conservative estimate of active poultry houses to which we can ascribe integrators is on the order of 1,853 or so. I think that's the exact number. Probably has more exactness to it than it deserves, but so a lot, 1800.

Q. Does that number change?

A. Yeah, it changes all the time. New houses are built, old houses become inactive or are torn down within the watershed. It's a dynamic circumstance.

Q. What do you see the size of houses, from what you've seen in the past to what you are seeing in the new ones being built today?

A. Well, there's really a whole stratigraphy to the houses. What you see today are larger houses, longer and wider. And you tend to see newer complexes appear to have more houses at them.

Q. You testified earlier today that the work that was being performed by you and your team was a complicated task. Could you tell the Court why that is?

A. Well, it's complicated for a number of reasons. Number

one is one you've just mentioned is that this is a dynamic circumstance. So that there were poultry houses that arose by construction that did not appear an our air photo and there were poultry houses that were demolished that had appeared on our air photo, so we had to document that. So it's an ever-changing circumstance in trying to ground truth the air photo. We also did not -- we had to develop a lot of the basis information ourselves from documents. So documents were being reviewed simultaneously with having individuals in the field looking at these sites.

Q. In your work with Dr. Engel, did you make a determination with regard to the BMP's exportation of waste?

A. Yes.

Q. And did you also make any determination about the amount of waste being imported into the IRW?

A. Yes, on two bases. On one, an anecdotal bases is that we had -- I had reviewed investigative reports and discussed with my investigators the fact that waste moved from areas to the north, basically the Eucha-Spavinaw Watershed was moved into the Illinois River Watershed. So we know there's direct importation.

Secondly, based on review of the ODAFF records, which are, you know, imperfect and cover a relatively small period of time, for those circumstances in which you know the origin and the -- of waste, there's more waste disposed net in the

Illinois River Watershed than was exported -- than traveled out of the Illinois River Watershed according to the ODAFF records, which end just before BMP's -- on our records before BMP's begins exporting.

Q. Did you have an opportunity to review the article that Mr. George referred you to just prior to lunch today with regard to your study in the Lake Eucha-Spavinaw area?
A. Yes, I did. I was able to review an online copy of an interim report that's, for all intents and purposes, the final report which was submitted last summer.
Q. Was your recollection and your testimony earlier today consistent with what you found in your report that you, in fact, wrote?
A. It was.
Q. And what was that?
A. It was that we saw increasing concentrations of metals in the lake sediments that was concordant with the increase in poultry numbers within the Eucha-Spavinaw Watershed.
Q. When you shared office space with Mr. Page and/or Mr. Miller, did you pay rent?
A. Yes.
Q. Was that rent at market rate?
A. Yes.
Q. With regard to the amount of money that's been paid to your company, you testified earlier about having as many as 30

employees; is that correct?
A. Well, most of them are part-time but, sure, I paid up to 30 some people on the payroll.
Q. Of that money paid to you, are there other expenses associated with it besides labor?
A. Well, labor costs certainly are the largest piece of that but also mileage expense for use of private cars, gasoline expense, rental vehicles, hotel expenses, expenses for food,

equipment, expendable supplies. There's -- there are a lot of direct costs attendant to any sort of investigation.

Q. You're talking about costs attendant to this investigation for this case?

A. That's correct.

Q. Have you had an opportunity to review any hydrograph information?

A. Yeah, in the course of doing this, of course, I've worked with Dr. Engel and folks at CDM looking at hydraulic response and we've looked at hydrographs from the Illinois River and its tributaries.

Q. For lack of a better form of a question, if I were to drop a cup of water into the top of the watershed, do you know how long it takes for it to get to Tenkiller Lake in a rainfall event?

A. In a rainfall event that would produce substantial runoff which would be a rainfall event, say, in excess of two inches

or so, you'll see materials leaving the watershed and entering Lake Tenkiller in somewhere between two and four days.

Q. Does, in your opinion, bacteria increase every time there is a land application of poultry waste?

A. I'm not sure I understand your question.

Q. I believe there was some questions by Mr. George to you about the increase of cattle and their defecating and it might increase bacteria.

A. Well, bacteria are living things and the cows themselves are active in excreting year round. When the poultry waste is cleaned out, it's cleaned out over a fairly -- mainly during a fairly tight time interval and is dumped on the landscape at that time. And so there's a real difference not only in terms

of type of animal, but a real difference in timing of what's happening with the waste because the poultry waste is dumped out beginning in the late, late winter and continuing into the late spring is the bulk of when poultry waste is disposed. And that's coincident with rainy periods within the watershed.

Q. And your contrast to cattle is they're there all year; right?

A. Cow is there all year.

Q. You were asked about the inability to, and then suspension of looking for Campylobacter in wells. Do you remember those questions?

A. Yes.

Q. Did you hear Dr. Teaf testify?

A. No.

Q. Is Campylobacter something that is easy to culture in the lab when it's been sampled?

A. Well, talking to the people who are expert in culturing Campylobacter in the lab, the answer is no, it's not.

Q. All right. There's some questions to you about the geoprobe used and its depth of 20 or 30 feet. Let me ask you this: Do you know what was the purpose for the use of the geoprobe in the State's investigation of these waters?

A. The purpose was defining pathways of movement of contaminants. And that was the overall approach in all of this was to start with the source, the waste itself, look at fields upon which the waste was applied, look at runoff coming from those fields, look at shallow infiltrating waters which you would do with geoprobe with the groundwaters, deeper groundwaters. So it was part of the pathway analysis.

MR. GARREN: No other questions.

MR. GEORGE: Briefly, Your Honor, if I may.

THE COURT: Yes.

RECROSS-EXAMINATION

BY MR. GEORGE

Q. Dr. Fisher, I'll refer you back to the Shoal Creek study, and I won't spend much time on it, but I just want to point out to you this was included in the materials that you considered

as part of forming your opinion; correct?

A. Yes, along with thousands of pages of material.

Q. You testified, I think, that there are fewer numbers of poultry in the Shoal Creek Watershed. Is that your understanding?

A. Well, the understanding from reading this fragment of this paper which is before me --

Q. Sure.

A. -- on the page that's labeled as page 2 and carries my Bates No. PI Fisher 00003294. It says, "A poultry CAFO normally consists of two to eight large poultry barns. Approximately 21,000 broilers are produced in each barn five to six times per year for an estimated annual production of 33 million chickens."

So within the four corners of this document, that's what it says.

Q. Sir, do you have a recollection as to the density of poultry farms in the Illinois River Watershed in comparison to the Shoal Creek Watershed?

A. I've not made that comparison.

Q. You do recognize, do you not, sir, that the Shoal Creek Basin is considerably smaller than the Illinois River

Watershed?
A. I suspect it to be smaller. I don't know how small it is.
Q. Sir, just before we leave this article, I want to make

sure we have a point of agreement. You do agree that the reference on the first page to the Springfield Plateau Aquifer is the same aquifer that you have been discussing in your testimony today?
A. I would agree that the Springfield Plateau is the same physiographic region so it would be the same kind of aquifer material.
Q. And the Shoal Creek Basin is also in the Ozark uplift area that you've been discussing; is that right?
A. Yes, it is.
Q. Sir, there was some question by Mr. Garren regarding what you have paid out of the half million dollars that you have been paid by counsel for the attorney general's office in this case, and I want to make sure I didn't misunderstand something. You've not used that money to pay the nine homicide investigators, have you?
A. Yes, I have.
Q. That money has come out of your paycheck?
A. It has.
Q. You hired the nine Tulsa police officers?
A. I did.
Q. And you paid them for their hours in the watershed?
A. I did.
Q. Now, one last point. You were asked by Mr. Garren about the relative size of Green Country in comparison to something

in the Shoal Creek paper. I want to make sure that the --
A. I don't know what the question was in particular, Mr. George.
Q. Let's make sure we have a point of agreement. You do understand, sir, that all of the complexes, not just this one shown here, but all the complexes owned by Green Country have exported their poultry litter --
MR. GARREN: Asked and answered, Your Honor.
THE COURT: Sustained.
MR. GEORGE: I got an answer to that already, Your Honor?
THE COURT: I believe so.
MR. GEORGE: Okay. Thank you, I'll pass the witness.
THE COURT: I believe we are through. You may step down.
THE WITNESS: Thank you, Your Honor.
THE COURT: Thank you, sir. The plaintiff may call its next witness.
MR. GARREN: Dr. Bernard Engel.

BERNARD ALLEN ENGEL

Called as a witness on behalf of the plaintiffs, being first duly sworn, testified as follows:
THE COURT: State your full name for the record, please.
THE WITNESS: Bernard Allen Engel.

THE COURT: Spell your middle name, if you would, please.
THE WITNESS: A-L-L-E-N.
THE COURT: Thank you. Mr. Garren, you may inquire.

MR. GARREN: Thank you, Your Honor.

DIRECT EXAMINATION

BY MR. GARREN:

Q. Dr. Engel, what is your current employment, please?

A. I'm a professor at Purdue University.

Q. And give us the highlights, if you would, briefly of your education.

A. Certainly. I received a BS and MS from the University of Illinois in agricultural engineering, received a PhD in agricultural engineering from Purdue University.

Q. I've given you a packet of information, along with the Judge and defense counsel. I'd refer you to the exhibit number State's No. 124, and would you identify that document?

A. Yes, this is my current CV.

Q. You prepared that?

A. Yes.

Q. If you would, please, establish for the Court what generally is the kind of work that you do.

A. Certainly. The research I do is generally related to hydrologic water quality modeling, development of environmental decision support software, and the teaching would be in related

areas including development of waste management plans.

Q. Does that work require you to examine and analyze data sets or sets of data?

A. Certainly. So both spatial as well as other large kinds of data sets.

Q. Have you testified before in courts or other administrative proceedings?

A. Yes.

Q. And have you published articles or other materials?
A. Yes, from my CV you would find that I have published extensively in some of the areas that we just talked about.
Q. If you would, please, establish what it is you were asked to do or perform relative to the preliminary injunction for the State of Oklahoma.
A. In general I was asked to evaluate the generation and management of poultry waste. More specifically, to quantify production of poultry litter by each of the defendants, all the defendants in total, to understand where it was disposed of, understand the timing of that disposal and also to understand how far from where it was generated disposal would typically take place.
Q. And are you here today as an expert on behalf of the State to testify on those subjects?
A. Yes.
Q. And did you collaborate with others in this work?

A. Yes, I did collaborate extensively with Dr. Fisher as you heard from his testimony.
Q. Who was responsible for devising the strategy to implement and to perform the tasks you've just described?
A. I devised the strategy and then worked closely with Dr. Fisher in carrying that out.
Q. Did you observe and supervise events or activities of him and his staff?
A. Typically Dr. Fisher supervised his staff. I tended to review summaries of materials, so worked more closely with Dr. Fisher.
Q. In that regard, can you tell the Court generally the kind of information that you did review?

A. Certainly. And let me maybe start from a more global perspective and move to more specifics. So certainly scientific literature, literature related to waste production and waste production standards, state reports from the Oklahoma Conservation Commission, for example, data sets of various types including the USDA Agricultural Census Data, the National Land Cover Data, the 2000 aerial photographs that Dr. Fisher described. Dr. Fisher described numerous materials that he and his staff compiled. I certainly did not analyze all of those individual documents but tended to look at the summary documents, data from ODAFF, data from the ANRC, so those would be many of the data types and sources.

Q. Did you have an opportunity to look at county tax records for the counties that -- wherein the IRW is contained?
A. I tended to look at the summarized data there. So I did see examples of those and saw how those were used to identify the types of poultry produced and to identify the integrators.
Q. Did you have available for your review information from the Eucha-Spavinaw management team?
A. Yes, and certainly that was a valuable source of data in understanding the amount of waste generated by poultry in a very similar situation.
Q. Whose task was it to gather or basically prepare the data sets for your review and analysis?
A. Dr. Fisher and his associates prepared the majority of the data sets. And again, I tended to look at summaries of those data in the analysis that I did.
Q. All right. I direct your attention to Exhibit 426 which would be at the back end of your pack or the last document in

there. Can you tell the Court what this document is?

A. 426 or --

Q. It says 426.

A. 426.

Q. It's the summary of your steps.

A. Okay. Yes, so this document summarizes one of the processes that was used to determine the amount of poultry waste generated in the IRW by the defendants' birds.

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Q. All right. I'd like to take you through these steps one by one. And then if you would tell us generally what was performed in each of those steps starting with, number one, the methods used to determine the number of active houses. Just briefly explain what you did.

A. Yes, Dr. Fisher provided a substantial amount of detail in doing this so -- in his earlier testimony. So the 2005 aerial photos were used to identify potential poultry houses. The active houses were identified then through field investigations as we heard from Dr. Fisher.

Q. You've given your deposition in this case, have you not?

A. Yes.

Q. And at that deposition did you or was it brought to your attention of coding errors in some of the data?

A. Yes.

Q. Tell the Court what that is about?

A. Certainly. So there was an instance in some of those data where there were four houses, as I recall, that were identified as Cargill houses. The identification of those were correct in that Cargill was the integrator, however those were identified as producing broilers which was incorrect. So the correct production in those should have been turkeys.

Q. Have you made a change -- let me ask you this. Did you discuss that change in your testimony at deposition?
A. Yes, I did.

Q. And since the deposition, have you made those changes in your data?
A. So the underlying data have been corrected and the waste generation has been adjusted accordingly.
Q. Does it change your overall opinion about this, that you've made in this case with regard to your deposition?
A. It doesn't change my opinion. It changes the amount of waste generated slightly.
Q. And what change did it reflect?
A. It slightly decreased the amount of waste generated.
Q. On what I believe is marked as State's Exhibit 429 -- actually it's 427, is the total waste generated, as calculated by you, shown on that exhibit?
A. Yes, so in the lower right-hand corner there's a total of 345,436, if I can read that correctly.
Q. All right. And that's the new number from the new data set correcting those four houses you just described?
A. Yes.
Q. I'll ask you now to look at Exhibit 130 in your packet of materials there. And if you would, just briefly describe to the Court what that is.
A. So Exhibit 130 is some output from the database. This identifies each of the active houses for which an integrator has been identified in the IRW, identifies the type of poultry produced, identifies the dimensions of the building, the

calculated area and then contains some information about the estimated waste generated within that house. And the last couple of columns identify a latitude, longitude location for that house.

Q. So with this information and with the aerial, if I wanted to go to a particular house, say, house number 88 which is shown on the second page of this Exhibit 130, it would coincide with the number 88 that's shown on Exhibit 427 that blow-up in that aerial; is that correct?

A. Correct.

Q. So that would be consistent with all the houses that have been identified as active houses in this watershed?

A. That's correct.

Q. I'll have you now refer to, if you would, please, this map up here. We'll try and go through this quickly because I think Dr. Fisher went through it pretty good. The codes that are on the database of 130 coincide with the numbers assigned to houses. Is that my understanding? Is that a correct understanding of the facts?

A. We're talking about the ID number?

Q. Yes, the ID, house ID.

A. Yes.

Q. All right. Let's move forward on the next item of your steps of calculation. How did you determine the grower/integrator affiliation for purposes of creating this

data?

A. So Dr. Fisher described that in detail in his testimony a bit earlier, but let me just quickly summarize. So this was done through a combination of investigators in the field and a

variety of records including tax records, records from ODAFF and other defendant-provided records such as directions for feed delivery and so on.

Q. Would the determination of the bird type be similar to what you just described in trying to determine the grower/integrator affiliation?

A. Yes.

Q. Tell the Court, in step four you talk about your calculation of house area. We see in the blow-up a -- in the upper left-hand corner, one of the barns are blown up in proportion and there's a scale there. Tell the Court what you did to determine the measurements of these houses.

A. Sure. So I worked with Dr. Fisher's team in accomplishing this task. So he and his team used the aerial photos in a geographic information system tool. That allowed one to zoom much as we see in the photograph here and, in fact, one could zoom in and see substantially more detail. And then using a tool within that geographic information system piece of software, one could measure the length and width of these and then capture that information in the database to be attributed to each of these houses.

Q. And was that done?

A. Yes, so that was done for all active houses for which the integrator had been identified.

Q. What was the reason for measuring the square footage of houses?

A. Well, in estimating the waste, the strategy that I ultimately devised and chose to use allowed us to take advantage of data from the Eucha-Spavinaw Watershed. And in

that particular case, there was data that allowed us to identify the amount of waste generated per square foot of house in that watershed. So my judgment was that our best tool for estimating then waste generated here was to use that coefficient, that amount of waste generated in this nearby area with very consistent data sets and apply that concept here. So we needed to have the area of each house in order to apply those waste coefficients.

Q. And what was the reason for your judgment to use the Eucha-Spavinaw data?

A. Well, ideally one would have liked to have used the integrator-provided poultry numbers, so that would have been my overall preference. Those didn't become available until just very, very recently. So the decision then to go with the nearby Eucha-Spavinaw data was that it was a like kind of situation, so these were houses with poultry production practices just next door to the IRW watershed. The data from

the nutrient management plans were put together by a very small group of individuals, so they were very consistent. So they were quite repeatable and very trustworthy as the Court had supervised the preparation and oversaw that information. So we were able to extract then supporting data from those.

Q. What did you do with that data once you did that, extracted it?

A. Well, if we go back to the spreadsheet we were looking at earlier, one of the columns you see on Exhibit 130 is an Ann Waste U Area. So it was an annual waste per unit area that was specific to the type of poultry being produced. So from the Eucha-Spavinaw data, there was an estimate derived from Eucha-Spavinaw data for broilers, one for turkeys, one for

layers and so on. So you'll see then in the spreadsheet or the output of the spreadsheet that those unique waste productions per unit area were used here. And then by multiplying that by the area of the barns in the IRW for each of these, one could generate a quite good estimate of the annual waste produced.

Q. I'll direct your attention then to Exhibit 137 in the packet. And tell the Court, if you would, what that is.

A. So Exhibit 137, the front of this contains a table that summarizes the waste production from Eucha-Spavinaw. So in this table there's a line for broilers, hens, pullets and turkeys, identifies the total numbers of birds, total waste produced from those based on the nutrient management plans, the

total house area. And then from that was computed the waste in tons per square foot per year, pounds per square foot per year, pounds per bird per year and so on. So this was the data that was used in the spreadsheet for the IRW calculations.

Q. This forms a basis for determining that waste per unit area. Is that essentially what we're looking at?

A. Yes.

Q. Let's look at Exhibit 128, if you would, please. And when you get there, I'd like you to tell the Court what it is we're looking at here and what this document will tell the Court.

A. So Exhibit 128 describes the process for estimating the poultry waste generated within the Illinois River Watershed. So the first page repeats some of the same process we just talked about. And then if one moves to the second page, the table here shows the waste generated by each of the defendants and that's broken apart by the poultry type.

Q. And at least as it pertains to the defendants, we see that

tabulation of total waste on Exhibit 427 which is the poster board with the map on it; is that correct?

A. Correct, so both of these indicate 345,436 tons per year.

Q. What is the purpose of the charts on pages 3 and 4 of this exhibit?

A. So the chart on page 3 shows the waste production by type of poultry. And so this would indicate that broilers are producing slightly more than 75 percent of the waste. And page

4 would show the amount of waste in pie chart form produced by each of the integrators. So these would be data taken from the table on page 2.

Q. Have you been able to review recent data obtained with regard to the number of birds produced by each of the integrator defendants?

A. I have.

Q. When did you, in fact, get that data?

A. My recollection is that I received that January 8 or so of this year.

Q. All right. And in reviewing that data, what did you find as to the total waste production?

MR. GEORGE: Your Honor, if I could interpose an objection. I think we're about to hear a previously undisclosed opinion; is that correct, Mr. Garren?

MR. GARREN: I think that's correct, although I believe there was discussion about the fact he had that data and just had not reviewed in detail that data.

MR. GEORGE: Your Honor, my only concern is I haven't seen the statistical analysis of whatever the witness is about to testify to.

THE COURT: That's right. I think it's clear at least

under the order that any data upon which any opinions were to be based, that the deposition had to be produced prior thereto. Now, the fact that he had the data but didn't produce it to the

defendants doesn't save it. Are you saying that you had produced it to the defendants?

MR. GARREN: Let me point out how we got it, Judge, the --

THE COURT: No, no, no, I mean, just real basically, did the data -- had you provided it to the defendants?

MR. GARREN: We only received it on January 8th from the defendants pursuant to the court order of Judge Magistrate Joyner to produce the number of birds for each of the integrators which had not been done prior to that. It's that data that I'm referring to.

MR. ELROD: Your Honor, I hope he's not representing that Simmons has withheld that data, are you, Rick?

MR. GARREN: No.

THE COURT: No, no, he's not saying it was untimely, he's just saying it was given --

MR. GARREN: I'm saying pursuant to a court order.

THE COURT: Right, right.

MR. GARREN: And the date of that order was January 8th to produce.

THE COURT: Right, so they did have access to the data because it's their data, you're saying?

MR. GARREN: Yes, it is the defendants' data.

MR. GEORGE: Here's the issue, Your Honor. If the witness wants to testify as to what information was provided

from the defendants in discovery, I have no objection to that whatsoever as a summary. I think this witness is going to take that data and perform an analysis on it that has not been disclosed.

THE COURT: I see. All right. Mr. Garren, in response?

MR. GARREN: That is correct, Your Honor. He is going to tell you what his estimate would be based upon data now supplied by the defendants that he didn't have before. And I will answer to Mr. Elrod, their 30(b)(6), they did provide their data in advance of all the other defendants. But in any event, he would take that data which is slightly different, compare it to the Eucha-Spavinaw data.

THE COURT: I understand. I'm going to allow it. Overruled, go ahead.

Q. (By Mr. Garren) If you were to use the bird number which you said you would prefer to have, do you get a different number in the total amount of tons produced in the watershed?

A. I do.

Q. Does that number go up or down?

A. It goes up.

Q. And can you tell us roughly what that number would be?

A. So my estimate using the USDA waste management handbook and using as -- the estimates of waste as it would be removed from poultry houses as described in that handbook indicate that

the estimated waste would be approximately 445,000 tons per year.

Q. Have you looked at information provided by the defendants' experts, and in particular Mr. Billy Clay?

A. Yes.
Q. Did you -- have you made a similar comparison to his projections of waste generated?
A. I have.
Q. And how does it compare to what you just testified as to the new 440 some odd thousand?
A. If one were to use Mr. Clay's numbers and approach -- and let me maybe illustrate the example he used for wild turkeys. So he had an estimate of approximately 3500 wild turkeys in the watershed. Back calculating the waste he used produced per day per wild turkey provides a number of 20 pounds per day. So assuming 20 pounds of waste per day per turkey and using the approximately two and a half million Cargill turkeys in the watershed, assuming 120-day production cycle for those. So Mr. Clay assumed wild turkeys were big all year in the watershed, one for just the turkeys would get a number in excess of 3 million tons per year.
Q. That doesn't seem right, does it?
A. I don't think so based on the other estimates that were derived by more standard kinds of techniques.
Q. Let me ask you now to turn to Exhibit No. 138, if you

would, please. Tell the Court what that document is.
A. What was the number again?
Q. 138. It has a land use, land cover table on it.
A. Okay, I found it.
Q. Tell us what this -- first off, tell us what is the source of the information contained in this document?
A. Sure, this was a calculation that I did using yet another technique to estimate waste generation. So in this first page

we see land use, land cover data for the Illinois -- well, for the counties that are partially in or fully within the Illinois River Watershed as well as the portions of those land uses for the Illinois River Watershed. This is based on the USGS 2001 National Land Cover Data Set.

Q. Why were you doing this work?

A. Well, another technique that one could use to estimate waste would be to understand the poultry production within the watershed. One of the challenges here is that the USDA only reports livestock numbers by county when they do the ag census. So there needed to be a way to allocate those in a reasonable manner to the IRW. And in my opinion, the most reasonable way to do that was based on the amount of pasture within the IRW based on the National Land Cover Data.

Q. When you did that, what did you find?

A. Well, again, what I found is that if one uses the ag census poultry production numbers, allocates them and then uses

standard USDA Agricultural Waste Management Field Book kinds of waste production numbers, that you get an estimate of approximately 528,000 tons of waste per year produced by poultry in the IRW.

Q. Is the ag waste handbook that you referred to something that's commonly used for these purposes?

A. Yes, and other things that would have similar values in it.

Q. When we're talking about waste that you're measuring, are there ways -- are there different ways to measure the waste?

A. Certainly. So the estimates of waste that I've been describing are estimates of the waste as removed from poultry houses. So other estimates of waste would be as excreted from

animals. Typically waste excreted by animals would be 88 to 90 percent water for cattle, for example, so that would be an as-excreted value. If one were to really want to make proper kinds of comparisons between the amount of waste generated, the common way of doing that would be on a dry weight basis --

Q. How do you -- I'm sorry.

A. -- in which water would be removed. So essentially someone has captured the waste from a group of animals, has put that in an oven, dried the water out of that and made then a measurement of the dry weight of waste produced by animals.

Q. And so to be clear on this, you used which method in order to weigh or estimate the amount of waste in this case?

A. So in this case, the 345,000 tons approximately is an as-removed from poultry houses kind of estimate. So it's based on data from Eucha-Spavinaw which was an as-removed number. The approximate moisture content in that would be in the 27 to 30 percent range in that particular instance.

Q. Is that generally the condition that it's in when it's land applied?

A. Yes.

Q. Let's now look at Exhibit 139, if you would, please, in your packet of exhibits.

A. I have it.

Q. And tell the Court what does this summary show and its purpose.

A. Okay. So this page identifies estimates of poultry waste produced in the Illinois River Watershed based on the 2002 Agricultural Census Data and the technique we described a few moments ago. The difference here is the USDA and MWPS, Midwest

Plan Service, estimates are estimates of waste generated in dry tons, so all water removed, no bedding in these materials. So these would indicate that somewhere between approximately 316,000 and 387,000 tons of dry material from poultry waste are produced annually in the IRW.

Q. So to compare apples to oranges, we would have to add 30 percent water content roughly to these numbers to what --

A. Yes, if one did that, that would put them on a comparable

basis to the 345,000 number that was generated using a different technique.

Q. So is this just another -- why did you look at these numbers with regard to these sources of the MWPS and, again, of the Agricultural Waste Field Handbook?

A. Well, looking at this from different approaches provides an opportunity to really bracket the potential range. So as we've heard, these calculations are fairly complex and therefore, using different approaches provided an opportunity to see what the expected range would be. And ultimately we went with the most conservative of those, the lowest number, the 345,000 tons.

Q. On an as-removed basis?

A. On an as-removed basis.

Q. Did you have an opportunity to also look at the work by Dr. Rausser and Dr. Dicks that were provided by the defendants?

A. I did.

Q. And did you see a reference in their materials to waste production?

A. Yes, so they indicated that from a conversation with Sheri Herron of BMPs, Inc., that typical waste removal from poultry houses was 200 tons per year.

Q. And how does that compare to your estimate that you provided today at 345,000?

A. It would be slightly higher. So as I recall based on the

number of houses in this calculation, the approximate per house number here is about 190 -- excuse me, about 190 tons per house per year compared to the estimate of 200 tons per house per year.

Q. By Ms. Herron?

A. By Ms. Herron.

Q. Now, we've talked about what's been generated. Let's move to another matter and that is the task of the method of disposal of the waste. Were you, in fact, asked to determine what was done with the waste once removed from the house by the State?

A. Yes.

Q. Was that part of your work in preparation for your testimony here today?

A. It was.

Q. Tell the Court what generally did you look at or review in order to form your opinion.

A. Well, certainly there was scientific literature, publications, extension publications from University of Arkansas, Oklahoma State University, state reports. And then there were data and especially data from ODAFF that were used to understand some relationships about how far waste was disposed of with respect to where it was generated.

Q. Did you have access to nutrient management plans that were in the information provided by the defendants in this case?

A. There were limited numbers of nutrient management plans in those data.
Q. Have you yourself personally observed poultry waste being spread by broadcast spreader?
A. I have. And in fact, I believe it was maybe even in this watershed over west of Springdale, west of Tontitown near where my brother lives.
Q. What have you, in your studies and research, determined is generally done with the waste?
A. Well, generally the waste is land disposed and typically within a few miles of the house in which it was generated.
Q. Did you determine whether or not the waste is used after it's removed from the house to further raise or grow poultry?
A. I did make that determination. It is not used for that purpose. It's disposed of on the land.
Q. Did you gather any data in order to determine how far the waste may go from its source of the poultry barn?
A. I did.
Q. And what did you do in that regard?
A. Well, there were some of the ODAFF records that allowed myself working with Dr. Fisher and his team to develop an understanding of how far the waste does go before it's land disposed.
Q. Did you prepare that into a chart form? And in particular, I'll draw your attention to Exhibit No. 140.

A. Yes, so I do have 140.
Q. Tell the Court, if you would, please, first off, did you prepare this document?
A. I worked with Dr. Fisher in preparation of this, yes.

Q. All right. And tell the Court what this document attempts to say or tell us.
A. So this document used ODAFF records between '98 and early 2006. Most of those records being between 2001 through 2004. And from some subset of those records, one could identify where waste was generated and where it was land disposed.
Q. And does this compile that data?
A. Yes, this compiles that data.
Q. What did you conclude or what could one reading this report conclude happens to the waste that's removed from the home or the poultry house?
A. Well, this indicates that the largest part that was generated inside the Illinois River Watershed was also disposed of within the Illinois River Watershed.
Q. You have a column here that says not given in tons. What does that mean?
A. Sure. What this indicates is that -- the column indicates -- this is where there was some confusion before between rows and columns here. The columns indicate where waste was disposed of. And so the not given means that in a particular set of records, the location of that disposal was

not given or could not be determined from those particular records.
Q. So was it excluded from your conclusion?
A. Well, the numbers in the not given were not used then in determining whether that waste was disposed of in the watershed because we couldn't tell, so it was excluded.
Q. All right. And the column border, do you know what's intended by that term?

A. Sure, because of the spatial specificity of the data, one could only identify to the nearest square mile where waste was generated and where it was disposed of because the locations were given as section, township, ranges for both generation as well as disposal.

Q. Do you have a summary of this material shown in the last page of this document?

A. Yes, if we turn to the last page, what we see is that for the records for which there was sufficient information to determine the amounts of waste that were generated and disposed of, that for the period between '98 and early 2006 for the ODAFF records, there were approximately 98,000 tons generated in the IRW. There were another almost 31,000 tons imported, 12,600 exported from the watershed and therefore, a grand total of about 116,400 that were land disposed of within the IRW.

Q. So we're clear then, these are ODAFF records; is that true?

A. True.

Q. So this would only apply to the Oklahoma portion of the IRW; correct?

A. Correct.

Q. And as I read what you just showed us in the last little table, there are more tons at this time frame being imported than there are being exported. Is that the way I read this?

A. For this time frame based on these records, that's correct.

Q. Now, this tells us what was done, it doesn't tell us the timing of when it's done. Have you prepared and examined data relative to the timing of the disposal of the waste from the barns?

A. I have.
Q. I direct your attention to Exhibit No. 134 and tell the Court if that is that data.
A. So, yes, 134 describes both distance from which -- from the poultry houses from which waste was generated to which it ultimately was land applied. And let me look just a moment. I don't believe this one has timing of that application in this one.
Q. Okay. So this is just the distance; is that correct?
A. This one is just the distance.
Q. And so generally speaking, what does it tell us? I believe there's two charts at the beginning, does that

summarize what the data tells us?
A. Right, so this is for all Oklahoma ODAFF data for which there was sufficient data to determine where waste was generated, where it was land applied. So the first graph is the same as the second graph except in the second graph we're now zoomed in on the first six miles of this. What this indicates is that based on ODAFF records, approximately 30 percent of the waste is land applied within one mile of where it's generated, approximately 60 percent within three miles and 80 percent within five miles.
Q. Have you reviewed data and information with regard to -- let me ask it this way. Do you have knowledge of any information that would reflect any different waste disposal practices in the Arkansas side of the watershed than the Oklahoma side?
A. I have no data that would suggest they're different.
Q. I'm going to ask you to look now at Exhibit 132, if you

would, please, and in particular, the last page of that document. I believe there's some repetition in these two documents.

A. Yes.

Q. This contains, I think, the same charts that are in Exhibit 134, but I wanted to get to the last page of Exhibit 132, if you would, please. Tell the Court --

A. It does also contain some different graphs as well.

Q. All right. Well, then let's go through it and see what I've missed here. We have all the Oklahoma data in the first chart which, I think, is similar to what we just saw, is it not?

A. That one is the same, yes.

Q. So the next chart is, in fact, the Illinois River; is that correct?

A. That's correct. So the same ODAFF data were analyzed for just the Illinois River Watershed and similar graphs were produced as to the ones we've just talked about.

Q. And what does it tell us that happens in the Illinois River Watershed?

A. It's a very similar story. I guess the slight exception is that, in fact, waste is disposed of even closer to houses in the IRW than the rest of Oklahoma. So again, approximately 30 percent within a mile, 60 percent within about two miles -- or 67 percent within two miles or so, and 80 percent within approximately 3.6 miles or so.

Q. From the ODAFF records, can you tell when these land applications occurred?

A. Well, some of the ODAFF records do identify the timing of land application. So not all of those records identify timing.

For those for which timing could be identified and for which the land application was in the Illinois River Watershed, that analysis was conducted.

Q. And is the last chart in this Exhibit 132 reflective of that analysis?

A. Yes, so Figure 5 identifies the timing of litter onto the land within the IRW based on the ODAFF records between '99 and 2004.

Q. And what is this chart essentially telling us about that application?

A. Well, this shows that the majority of the waste disposal, about 55 percent of waste disposal, occurred between February and May for that time period.

Q. Now, did you also have an opportunity in looking at Rausser and Dicks' declaration prepared for the defendants in this case, if he made or they made any determination about where poultry waste is applied?

A. Yes, the Rausser and Dicks information indicated that all 345,000 tons of poultry waste that was generated in the IRW was applied in the IRW based on their base assumption.

MR. GARREN: One moment. I'll pass the witness, Your Honor.

THE COURT: Cross-examination.

MR. GEORGE: Your Honor, my examination will probably take about 40 minutes. I don't know if that should be factored into an afternoon break, whether you'd rather do it now or later.

MR. GARREN: If I may move for the admission of the

exhibits that we referred to, I'll do so at this time.
MR. GEORGE: No objection.
THE COURT: Very well, do we have numbers of those exhibits, Mr. Overton?
MR. GARREN: I'll make sure he gets them.
THE COURT: Very well. Let me ask our transcriptionist here, would this be a good time to break or do you want to go on a little further? Let's take a 10 minute break.
(Recess.)
THE COURT: Mr. George.
MR. GEORGE: Thank you, Your Honor. Before I examine the witness, can I move for introduction of two exhibits that were used on cross-examination of Dr. Fisher?
THE COURT: Yes, sir.
MR. GEORGE: They are identified as Defendants' Exhibit PI-44 and Defendants' Exhibit PI-43.
THE COURT: Any objection to 43 and 44?
MR. GARREN: No, Your Honor. It's my understanding that Mr. George provided a complete copy for Exhibit 43 and we have no objection.
MR. GEORGE: That is correct.
THE COURT: Very well, PI-43 and PI-44 are admitted.
MR. GEORGE: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. GEORGE
Q. Dr. Engel, good afternoon. You and I have met before, have we not?
A. Yes.

Q. Dr. Engel, you recall providing an affidavit in support of the attorney general's motion for a preliminary injunction in this case?
A. I do.
Q. Have you reviewed that affidavit recently?
A. It's been kind of recently, I suppose.
Q. Can we put it on the screen, Dr. Engel's affidavit. And could you go to paragraph -- I think it's on page 3. Sir, do you see on page 3, the estimate of the amount of poultry litter generated in the Illinois River Watershed annually that you provided in your affidavit?
A. Yes.
Q. And can you state that number for the record, please?
A. Approximately 347,000 tons.
Q. Dr. Engel, today I heard you to testify to several numbers other than that one. You testified that you had calculated 345,000 as shown on Demonstrative Exhibit 427; correct?
A. Yes.
Q. You also, I believe, testified that using a different method that you had arrived at an estimate of 445,000?
A. Correct.

Q. And another estimate produced a range of between 316 and 380 tons; correct?
A. Correct, but those were dry.
Q. Okay. And still you had another estimate and method that you employed produced a number of approximately 528,000 tons. Do you recall that?
A. Yes.
Q. Dr. Engel, what is your number today?

A. Well, the most conservative of the numbers is the 345,436, if I can see correctly from here. It's a little bit tough. So certainly there are a range of estimated values and the smallest of those and the most conservative of those is 345,000 and change.

Q. Dr. Engel, you believe that estimate of 345,436 is a reasonable estimate of the amount of poultry litter produced in the Illinois River Watershed annually?

A. I do.

Q. Now, sir, out of that 345,000 ton estimate annually, how much have you been able to document has actually been land applied in the watershed?

A. Well, I guess the amount that is actually documented as being land applied would be with the ODAFF records.

Q. Can we go to those, Exhibit 140, please, State's Exhibit 140. And you discussed this exhibit with Mr. Garren, do you recall that, you created this summary?

A. Yes.

Q. And I apologize, I'm not sure that I fully followed it. Can you go to the second page, to the summary section. And tell me which of those numbers or combination of numbers would total the amount that you have been able to document were land applied over this period of time in the Illinois River Watershed? Do you still have it, Dr. Engel?

A. I'm looking here, just a moment. So the -- probably the easiest place to look at that is on the very last page of this exhibit.

Q. Okay. Can you point me to the number that would reflect the total amount that you were able to document has been land applied over this period of time in the Illinois River

Watershed?
A. So based on the ODAFF records for which there was sufficient data to make that determination, the disposed of in the Illinois River Watershed would be 116,400 tons.
Q. And over what time period were those 116,400 tons land applied?
A. The records range from March 31, 1998 through April 5, 2006, with the majority of those being 2001 to '4, as I recall.
Q. So that would be about an eight-year time frame for records, do I have that right?
A. Approximately.
Q. And so if we wanted to take that number and turn it into

an annual average based upon your documented land application, that would be somewhere around 15,000, is that right, 116 divided by 8?
A. Yes, if you simply do that math, that would be correct.
Q. Now, sir, in this document, Exhibit No. 140, you use the term poultry waste disposal where disposal appears consistently. Is that the term that is used in the Oklahoma Department of Ag records that you reviewed to assemble this document?
A. I don't recall what term is used in those records.
Q. As we sit here today, sir, do you have any recollection that the Oklahoma Department of Ag records regarding land application of poultry litter refer to that as disposal?
A. I don't have a recollection.
Q. Okay. Is the term disposal your term in this document, that's the term you chose to describe it with?
A. It's a term that would commonly be used in literature when

describing poultry litter land application or disposal. It's a common term in many places.

Q. Now, with respect to the land application events that are recorded here on Exhibit 140, why are poultry farmers in Oklahoma reporting the amount of poultry litter that they have applied? Do you know?

A. I'm not sure that it's the poultry growers that are reporting those numbers. So recall that the ODAFF records are

made up of producer data as well as land applicator's data. So I believe the application piece of this is largely from the land applicator's portion of those records.

Q. Isn't it true, sir, that the reports that you have summarized here are reports that are made by individuals who are land applying poultry litter because they have received a permit from the Oklahoma Department of Ag to do so?

MR. GARREN: Object to the form of the question, Your Honor.

THE COURT: Sustained. Rephrase.

Q. (By Mr. George) Isn't it true, Dr. Engel, that the records that you are summarizing here reflect reports made by poultry growers or others pursuant to animal waste management plans that have been issued by the State of Oklahoma?

A. That's my understanding.

Q. Okay. So you're not suggesting, are you, sir, that any of these land application events that you have summarized here were unlawful, are you?

A. No, I'm not.

Q. Now, Dr. Engel, let's use your 345,000 ton estimate, okay?

A. Okay.

Q. Out of that amount, how much of that tonnage is bedding as

opposed to excrement?
A. I guess I'm not sure as to the amount exactly that would be bedding.

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Q. Well, you do concede, do you not, sir, that a substantial portion of the 345,000 tonnage would be comprised of bedding?
A. Substantial, I'm not sure I would agree with substantial, but certainly some portion of the 345,000 would be bedding.
Q. What are the common types of bedding material used by poultry growers in the Illinois River Watershed?
A. I believe that would be wood shavings and rice hulls.
Q. Dr. Engel, are you aware of any particular hazards associated with placing rice hulls or wood shavings on the ground?
A. I'm not, but I guess I would go further that once they have been mixed with the poultry waste, they, too, would be carrying bacteria, would be carrying other materials with them and it would be very, very difficult to separate them.
Q. Now, out of the 345,000 figure estimate, you agree that some of that amount that is produced in the watershed is actually exported; correct?
A. Yes.
Q. And you heard Dr. Fisher testify that he was aware that last year BMPs, which is an organization that operates in this watershed, have been involved in exporting about 70,000 tons. Do you recall that?
A. I recall that, yes.
Q. Now, are you also aware, sir, from having spent time in the watershed and studied the marketplace, if you will, for

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poultry litter, that some growers actually export their litter outside of BMP, just arm's length transactions between them and a buyer who happens to be on the outside of the watershed?

A. That would certainly be a possibility.

Q. Have you attempted to document that export?

A. I have -- I guess to the extent that the ODAFF records would document that, you know, that's been described in Exhibit 140.

Q. Now, with respect to the ODAFF records that you reviewed, you reviewed those in part to support your opinion about how far poultry litter may generally move from a house before it is land applied; is that right?

A. Correct.

Q. And I believe a fair summary of your testimony was somewhere between one and five miles is pretty common; is that right?

A. Typically five miles or less would be common for 80 percent of the disposal.

Q. That's with respect to the Oklahoma side; correct?

A. Correct.

Q. Now, sir, you also received information from the Arkansas Natural Resources Commission; correct?

A. I received some information from them, yes.

Q. Sir, did you perform any statistical analysis regarding the typical range of transportation for poultry litter on the

Arkansas side of the basin?

A. Well, unfortunately the form of the ANRC data is such that it doesn't permit that type of analysis.

Q. Are you aware that there are some land uses that are

constraining on agricultural practices in the Arkansas side of the basin that are not present in Oklahoma?

A. Certainly.

Q. There's substantial urban areas in the Arkansas side of the basin; correct?

A. Correct.

Q. Sir, what, if any, basis do you have to suggest to this Court that poultry litter transportation and usage practices on the Arkansas side of the basin, in terms of how far it may move, is the same as what you have calculated for Oklahoma?

A. I guess I would point to an Arkansas extension publication. I believe the Rausser-Dicks declaration that you provided assumed that all waste in the watershed was land applied in the watershed, all 340 some-odd thousand tons. So, you know, based on those pieces of information, I think it's reasonable to assume that, you know, it's the same in Arkansas.

Q. So you're relying upon the defense experts of Rausser and Dicks for your opinion regarding litter application practices in Arkansas?

A. Well, I would rely more heavily on the University of Arkansas extension publication that indicates this is quite

close. And there would be a number of refereed publications from University of Arkansas from Edwards from Sharpley and others that also identify waste application as being quite close to where it's generated in Arkansas.

Q. Sir, do any of those publications that you are referring to employ the statistical analysis that you employed in Oklahoma to arrive at a range of transportation?

A. Those specific studies did not. I guess I could point you

to a couple of other studies that used somewhat different techniques but arrived at essentially the same conclusions.

Q. Sir, are you aware of the operations of George's Farms in this watershed?

A. I'm not sure what you mean if I'm aware of the --

Q. You're aware that one of the -- I'm sorry, I didn't mean to cut you off. Were you through?

A. I wasn't sure what you meant, sorry.

Q. It was a poor question, I apologize. You have identified farms in Arkansas that are under contract with George's; correct?

A. Correct.

Q. You're aware they do operate in the Arkansas side of the Illinois River Basin?

A. I would have to study the map carefully to make sure I didn't misspeak, but I assume they do.

Q. Are you aware of the fact that some of the farms under

contract with George's on the Arkansas side have been transporting poultry litter as far across the state as to the Delta region on the eastern part of the State of Arkansas?

A. I wasn't aware of that.

Q. That would substantially increase your average of transportation, would it not, if you included that in your analysis.

A. It may and may not. So the statistics I provided really were describing the spatial distribution of that transportation. So again, in those statistics, they indicated that approximately 80 percent of the litter was applied within 3.6 miles in the Illinois River Watershed. So one could export up to 20 percent to China, I suppose, if they wished, and that

wouldn't change those numbers. So export to the Delta may or may not change those numbers.

Q. Dr. Engel, your 345,000 tonnage estimate is based upon the number of active houses provided to you by Bert Fisher; is that right?

A. That's correct.

Q. If Mr. Fisher's estimate of the number of active houses is overstated, then your estimate would be overstated in terms of litter production; is that right?

A. Well, using this technique, that would be correct. And I, again, would note that this is based on active houses for which integrator has been identified. And I recall that there's some

130 additional houses that have been identified as being active for which an integrator has not been identified. And so, again, to be conservative, those approximately 130 active houses were not included in this estimate of 345,000 tons.

Q. Well, sir, are there integrators who have contract growers in the Illinois River Watershed who have not been sued by the attorney general?

A. To my knowledge, no. The issue with the unidentified integrators to these houses is that they sit in positions from which it's been impossible to determine from public vantage points who the integrator might be. Some of the records have not been sufficient to identify the integrator. So, you know, as Dr. Fisher and his group continue to analyze additional records, it's highly likely that some of that additional 130 will ultimately have an integrator identified.

Q. Let me switch gears on you, Doctor. You and your wife raise chickens on your farm back in Indiana, do you not?

A. Well, my wife has five chickens or so, as I recall.
Q. Those chickens produce litter and manure that has bacteria in it; correct?
A. Yes.
Q. You have children living on that farm; correct?
A. Well, children may be strong.
Q. Do you have a child?
A. They're adults.

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Q. You have had children living on that farm; correct?
A. Correct.
Q. Have you taken any particular precautions to protect yourself or your wife or your children from bacteria in poultry litter?
A. I have not.
Q. You and your wife use the litter and manure generated from those chickens as fertilizer on your farm, do you not?
A. Yes.
Q. Use it in your garden to increase production of vegetables; is that right?
A. Yes.
Q. And you've applied it to pastures to increase forage production; correct?
A. Well, the waste from five chickens doesn't go far in improving pasture production for 100 acres.
Q. Have you applied it to pastures?
A. Yes.
Q. Okay. And what was the purpose of applying it to a pasture?
A. For fertilizer purposes.
Q. Was your comment that you wish you had more?

A. Well, I wish she had fewer livestock in general, but that's another discussion.

Q. Go back to the affidavit. Dr. Engel, you were retained in

this case not necessarily as the chicken house counter, but as a fate and transport expert; correct?

A. That was one of the things for which I've been retained.

Q. In fact, in your affidavit, can you read the highlighted sentence where you are describing for the Court what is your role in this case?

A. Do you want me -- just the highlighted piece?

Q. Yes, sir.

A. So I've been asked to evaluate the movement of this waste and its constituents in the streams, rivers and groundwaters within the IRW and into Lake Tenkiller.

Q. And, sir, your background is one in which you have had opportunity to evaluate on a watershed-wide basis the contribution of various sources to water quality; correct?

A. I have.

Q. And, in fact, you have a pretty extensive background, do you not, sir, in the area of hydrologic modeling?

A. I do.

Q. And you have used hydrologic models -- let me back up for a second. Can you explain to the Court what is a hydrologic model?

A. Certainly. So typically these would be a series of equations that have been coded into a computer code to create a representation of how water behaves in the environment. So how -- there may be rainfall, how that may interact with the

ground surface, some of that potentially moving into the groundwater, some of that potentially running off and carrying materials with it.

Q. You agree there are some pretty sophisticated computer models out there that can be used to evaluate the likelihood and relative contribution of various sources impacting water in a watershed?

A. Certainly.

Q. Have you conducted a water quality model or fate and transport model, sir, in order to evaluate the extent to which the land application events that you have identified would be likely to affect the Illinois River or its tributaries?

A. Not for bacteria.

Q. You worked on that for other constituents?

A. For other constituents.

Q. But you haven't performed that analysis with respect to bacteria?

A. Not for bacteria.

Q. Were you asked to perform that for bacteria?

A. I was not.

Q. Now, these hydrologic models that you're using on some other part of the case and that you've worked with in the past, they're commonly used in the formulation of TMDLs, are they not?

A. Many of them are used for TMDL purposes.

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Q. Sir, you have experience, do you not, sir, in working with regulatory bodies in evaluating source contribution through models and other devices to fashion TMDLs or draft TMDLs?

A. I have, yes.

Q. Sir, you will agree with me as someone who has expertise in fate and transport that there are a host of site-specific factors that will control whether bacteria from a particular poultry litter application or any other potential surface source can be reasonably expected to make it to the Illinois River or Lake Tenkiller?
A. Yes.
Q. And some of those factors would include what, site-specific factors?
A. Well, the site-specific factors may include soils, may include location with respect to streams or other features of interest, may include topography, may include application of waste, amount of waste, content of that waste. So those would be some of the more important factors.
Q. And each of those factors in a system with the diversity of the Illinois River Watershed would vary from land application site to land application site; correct?
A. They would certainly have the potential to.
Q. Sir, have you conducted any analysis to determine whether any particular land application site identified by you in your work in this case has, in fact, contributed to the bacteria

levels found in the Illinois River, its tributaries or Lake Tenkiller?
A. I have not conducted such an analysis.
Q. Are you familiar with the term hotspots?
A. Yes.
Q. What does that term mean in the context of watershed planning?
A. Certainly. So the discussion we just had about how

site-specific kinds of factors may influence the potential movement of water and constituents that it may carry varies. Those locations that would tend to have combinations of these factors that would contribute substantial and disproportionate amounts of contaminants might be termed hotspots. And there would be other terms as well.

Q. Sir, are you aware of the fact that the EPA has encouraged regulators to not make generalizations about source categories but -- in their regulatory programs, but to focus on those hotspots in trying to control and improve water quality?

A. That's an approach that's commonly used, yes.

Q. Sir, you've spent a good bit of time today discussing the amount of poultry litter generated in the watershed. Have you evaluated the magnitude of any other source of bacteria in the watershed?

A. Well, with poultry litter I didn't evaluate the amount of bacteria for poultry litter. And you know, I did some quick

back of the envelope calculations based on some materials that Dr. Clay provided to try and understand the approach he was using and how he arrived at bacteria, but that was the extent of any bacteria calculations.

Q. Sir, you have been involved, have you not, sir, in the past in studies that have found that the urbanization of a watershed can increase the level of bacteria in surface water?

A. Yes, urbanization and, therefore, the sources of contamination that go with it have the potential to do just that.

Q. And you are aware, are you not, sir, that there has been substantial urbanization of both Benton and Washington County in the IRW, the Illinois River Watershed, in the past 20 years?

A. Correct, but I guess one needs to be a little bit careful in connecting those statements for the following reasons. So it's important as to the land use that's converted to the urban land use. So if one were to convert pasture that had heavy application of poultry litter to urban, in fact, the bacteria might go down. If on the other hand, you converted forestry to urban, then the bacteria from that area may go up.

Q. You're not suggesting, are you, sir, that every area of urban development in northwest Arkansas was previously a pasture that had received poultry litter, are you?

A. I don't think I said that.

Q. You don't have any data to support that notion; correct?

A. I have not analyzed any data to look at that issue.

Q. The installation of parking lots and impervious surfaces will result in increased bacteria levels in surface waters; correct?

A. Well, it has the potential to. So just the parking lot itself will not, but it has the potential to allow materials to accumulate there and has the potential for increased runoff.

Q. You looked at aerial photographs for Northwest Arkansas over the last 20 years to determine the degree to which previously foraged areas have been converted to concrete or asphalt surfaces?

A. I've seen photographs, but I've not conducted the kind of analysis you're describing.

Q. Was that time series striking to you in terms of the amount of development?

A. Certainly.

Q. Sir, did you estimate the amount of cattle waste generated

in the Illinois River Watershed?

A. I did not.

Q. Did you estimate the amount of wastewater containing bacteria that is discharged directly into the Illinois River?

A. I've seen values with respect to wastewater, but did not look at the bacteria component of those. I'm not sure that I've seen any data related to the bacteria portion of any wastewater discharges.

Q. You don't deny, do you, sir, that wastewater from a POTW would contain bacteria?

A. It certainly has a --

MR. GARREN: Your Honor, I'm going to object. I've been patient, but we're going down a line of an area that this expert has said he was not hired nor has he done work on and that is bacteria. He's testified about waste and if the questions are about waste, then I'll remove my objection, but not bacteria.

THE COURT: Any response?

MR. GEORGE: Your Honor, the point is what he didn't consider and that's relevant to the credibility of his opinion.

THE COURT: Overruled.

Q. (By Mr. George) Dr. Engel, did you produce an estimate of the number of geese or ducks who deposit fecal matter that may contain bacteria into the streams and rivers as part of your work in this case?

A. I did not.

MR. GEORGE: Your Honor, I'll pass the witness.

THE COURT: Mr. Garren.

REDIRECT EXAMINATION

BY MR. GARREN:

Q. Dr. Engel, are documents still being reviewed and records still being updated with regard to the waste analysis that Mr. Fisher is assisting you with?

A. Yes, as I indicated, you know, there were numerous documents that have been received and it's taking time to go through those. And so some of the active houses for which an integrator has not been identified may ultimately have an integrator identified.

Q. Based on your review of the records of ODAFF and the number of birds that are reported to have been produced during that same time period for which the, I think it's Exhibit 150, shows the total production of -- actually the total land applied that you say is documented, do you have an opinion about whether or not the number of birds associated with that number accurately reflects the amount of waste that is land applied?

A. One has to remember that this was only a portion of the ODAFF records. So in many instances, the location of disposal was not given. In other cases, the units were very difficult, if not impossible, to interpret. For example, number of truck loads of waste removed, in some cases it was in liquid form. So those data were not used in the ODAFF record analysis.

Q. Do you have an opinion whether or not the amount that's being reported as being applied is consistent with the amount of poultry that appears to be grown in the Oklahoma side of the IRW during that time period?

A. Based on the numbers of houses, based on agricultural census data, one would get a substantially higher estimate of

waste than the ODAFF records reflect.
Q. You've indicated that there are several sources indicating that application of that waste occurs quite close to the house. Do you know of any other reasons why it doesn't transport at length, greater lengths?
A. As I understand, the poultry waste is a fairly non-dense kind of material and as a result, the nutrient value per truck load is relatively small. So one can't afford to transport it very far before one loses most of the economic value and so thus, the practice has been to dispose of that quite near the houses as the data indicate.
Q. Do you know if the ODAFF records reflect the disposal -- waste disposal of all the defendants in this case?
A. I'm uncertain as to if they were all represented in those ODAFF records, without going back and reviewing some of those.
Q. If Mr. George's statement is true that George's operation is transferring waste out of the IRW, is there an underlying admission in your opinion in that statement?
A. That would seem to indicate that they're not finding value for those nutrients nearby or are potentially concerned about environmental impacts of disposal and so, therefore, are transporting to other locations.
MR. GARREN: One moment. I'll pass the witness, Your Honor.
THE COURT: Recross.

RECROSS-EXAMINATION
BY MR. GEORGE
Q. Dr. Engel, have you ever spoken with anyone at George's as to why they might be moving poultry litter to the Delta?

A. I have not.
Q. Were you just speculating about why, one possible reason as to why that might be occurring?
A. Well, certainly the literature would all seem to indicate that, you know, you lose the economic value after you transport this more than a few tens of miles, including the Rausser-Dicks materials that you provided.
Q. You have no idea why they transferred it to the Delta, do you?
A. Well, most likely it's either because --
Q. Sir, do you know why they transferred it to the Delta?
A. I don't know exactly why George's does that.
MR. GEORGE: Okay, thank you.
THE COURT: You may step down. The plaintiff may call its next witness.
MR. NANCE: Your Honor, State would call Dr. Gordon Johnson.

GORDON VERNON JOHNSON

Called as a witness on behalf of the plaintiffs, being first duly sworn, testified as follows:
THE COURT: State your full name for the record,

please.
THE WITNESS: Gordon Vernon Johnson.
THE COURT: Mr. Nance, you may inquire.
MR. NANCE: Thank you, Your Honor.

DIRECT EXAMINATION

BY MR. NANCE:
Q. You've told the Court your name. Would you tell the Court what you have done in your professional career, particularly at

the Oklahoma State University?

A. I served as extension soil nutrient management specialist and director of the soil, water and forage testing laboratory.

Q. And for what period of time were you at Oklahoma State University?

A. I was there from 1977 through 2004.

Q. Were you, at least in 2003 and '4, the regent's professor of soil science at the university?

A. Yes.

Q. Let me ask you to look at Exhibit No. 84 and ask if that is your curriculum vitae current through March of 2003?

A. Yes.

Q. And other than the fact of your retirement in 2004, is there any change that needs to be made to that?

A. No.

Q. Have you testified as an expert witness in court cases before?

A. Yes.

Q. Dr. Johnson, in the field of nutrient management, is there a measure of the amount of phosphorus in the soil which is available to help plants grow?

A. Yes.

Q. What is that called?

A. That's called the soil test phosphorus.

Q. That is abbreviated STP?

A. Yes, it is.

Q. Would you tell the Court please what STP does?

A. The soil test phosphorus identifies the extent to which a deficiency for phosphorus exists in the soil. And, in fact, that's the usual case or reason for taking a soil sample and

getting an analysis, that is to identify nutrient deficiencies that might be limiting crop production.

Q. How is STP expressed in Oklahoma?

A. As pounds per acre.

Q. Is there a chemical test that the State of Oklahoma uses to determine STP?

A. Yes.

Q. What's that test called?

A. That's the Mehlich III.

Q. Does the laboratory at OSU perform those tests?

A. Yes.

Q. Would you tell the Court please why a good soil sample is

important in crop growth?

A. Well, a good soil sample and the subsequent soil test is important because the deficiencies of nutrients in the soils cannot be ascertained through looking or touching or feeling the soil. This is a chemical property and it requires a chemical assessment.

Q. Okay. Typically in Oklahoma, do soil tests check for other nutrients besides phosphorus?

A. Yes.

Q. What are those nutrients, please?

A. Those would be nitrogen, potassium and then the soil pH.

Q. Has the Oklahoma State University determined the amount of nutrients that various crops need to grow?

A. Yes.

Q. Are you familiar, sir, with the crops that grow in the Illinois River Watershed?

A. Yes, I am.

Q. Would you tell the Court, please, principally what those crops are?

A. Those would be the forage crops of fescue and Bermuda grass.

Q. If Mr. Hammons would put up on the Elmo Exhibit No. 91, let me ask you if you are familiar with that document?

A. Yes, I am.

Q. What is that, please?

A. That's the OSU Soil Test Interpretations Fact Sheet 2225 which is used to interpret soil tests.

Q. Mr. Hammons, if you could put up page 2, let's look at that briefly. Those are pretty small on the screen, but let me ask you if the data on page 2 are the primary nutrient soil test interpretation for selected grasses and silage?

A. Yes.

Q. And does that show the nitrogen, phosphorus and potassium requirements determined by Oklahoma State University?

A. By their soil tests, yes. That page includes the calibrations for Bermuda grass and fescue.

Q. All right. Let's look at Exhibit 411 if we could, please, Mr. Hammons. If you could put that up as well. Is Exhibit 411 a summary of part of the soil test interpretation for phosphorus for Bermuda grass?

A. Yes, it is.

Q. Would you tell the Court, please, what the left-hand column of that chart that's labeled soil test P represents?

A. That represents the soil test phosphorus levels ranging from zero to 65.

Q. What does the center column show, sir?

A. The center column shows the degree to which the soil is

providing sufficient nutrients associated with those soil test values.

Q. All right. And what does the third column labeled

fertilizer P2O5 pounds per acre indicate?

A. That's the associated amount of fertilizer P2O5 that would be required annually per acre to correct that deficiency for that year.

Q. Okay. As an example to run through this once for the Court, would you explain what the values for soil test phosphorus 40 mean as you run across the table?

A. Yes, if you have a soil test 40 for a field, then that would indicate a 5 percent deficiency of phosphorus. And that if you applied 20 pounds of P2O5 as a fertilizer or nutrient input, you would expect to get a 5 percent increase in yield as compared to not applying that fertilizer.

Q. All right, sir. The bottom line where it says 65 plus, what does that line signify?

A. That means that once the soil test has reached a level of 65 or above, the soil is 100 percent sufficient in meeting the crop's requirement and there's no additional fertilizer required.

Q. All right, sir. Let me ask you, and Mr. Hammons, if he would put up Exhibit 412, is that Exhibit 412 simply a graphic representation of the chart that you just discussed with me?

A. Yes, it is. And it shows again that once a soil test of 65 is reached, there's no increase in yield with higher soil test values.

Q. All right, sir, thank you. Let me ask you, if I could,

Dr. Johnson, what is the approximate ratio of nitrogen to phosphorus in poultry litter?

A. It's approximately one to one for nitrogen and P2O5 phosphorus.

Q. Okay. Thinking particularly about Bermuda grass and fescue, what's the ratio of the need for nitrogen to phosphorus in those two grasses?

A. Well, we can't identify the need without the soil test, but the ratio of nitrogen to phosphorus in the plant material is about eight to one.

Q. So if poultry waste is applied to meet the phosphorus -- excuse me -- the nitrogen need of those crops, would you be applying more or less phosphorus than is needed?

A. You would be applying several times more phosphorus than would be needed in the plant.

Q. All right. Can poultry waste or poultry litter be custom blended to meet the specific nutrient needs of particular crops?

A. No.

Q. And is poultry litter or poultry waste used, to your knowledge, in feeding poultry?

A. To my knowledge, no.

Q. As a general rule, sir, in the Illinois River Watershed since the primary crops you've testified are fescue and Bermuda grass, is the feed that the poultry eats grown in that

watershed or does it come from outside the watershed?

A. It is coming from outside the watershed.

Q. In your affidavit filed in this case, Dr. Johnson, you indicate that under certain circumstances additional

application of phosphorus from poultry waste is waste disposal. Do you recall that?

A. Yes.

Q. Why did you say that, sir?

A. I said that because I reviewed several different sources of soil test data showing soil test phosphorus levels and identified that the majority of those are so high that there would be no agronomic benefit to apply more phosphorus to those fields. And that if it is applied and if poultry waste is disposed of on the land, there's no agronomic phosphorus benefit.

Q. All right, sir. Is commercial nitrogen available if, for instance, there's adequate phosphorus in the soil, but the crop still needs nitrogen?

A. Yes.

Q. Would you tell the Court, please, what repeated applications of excessive phosphorus above the agronomic level does to the STP of soil?

A. The STP will increase with repeated excessive amounts of phosphorus.

Q. Okay. In your opinion, sir, is -- are extremely highly

elevated phosphorus levels evidence of waste disposal of phosphorus?

A. Yes, they are.

Q. And why is that, sir?

A. Well, in the 15 or so years when I was director of the soil testing laboratory, I reviewed several thousands of soil test results and very seldom did we find any that were over 100. And in these cases where I've examined soil test values,

there are several fold that level. And so it's my opinion that the litter that's being disposed of on these fields is not providing an agronomic prosperous benefit and is being disposed of as waste.

Q. Does that lead you to conclude, sir, that historically poultry waste has been applied in the Illinois River Watershed in excess of what the plants need?

A. Yes.

Q. Okay. Let's look at some examples. Mr. Hammons, if you would put up 414, please.

Now, Dr. Johnson, before we talk about the numbers on this table, would you tell the Court just in general terms what you're portraying here and what the source of the data was?

A. The source of this data is the soil test results from the Arkansas -- University of Arkansas public laboratory for Washington and Benton Counties for forages. These are soil tests that were identified with forages and, therefore, the

years from 2000 through 2006. On this exhibit, I have calculated the average soil test value for each of those years and included the number of observations in that data set.

Q. All right, sir. Let's drop down to the very bottom line there. And would you tell the Court, please, what the average of these soil test phosphorus values are for Benton and Washington Counties from the period 2000 to 2005?

A. For Benton County, the average soil test P for the period 2000 to 2005 is 174 out of 299 observations. The average for Washington County is 140 for that time period and represents 223 observations.

Q. All right, sir. Would either one of those values be at least twice what the agronomic need for phosphorus is?

A. Yes, they would. They're essentially three times.
Q. Okay. Would you tell the Court what happened to the values in 2006?
A. Well, in 2006, there was a dramatic increase in the number of soil samples that were received by the laboratory for these counties identified with these forages. And associated with that increase in number of samples, there was a dramatic increase in the average soil test value as well.
Q. And --
A. And this is a result of a rule going into effect in Arkansas in 2006 that required anyone applying animal manure to the land to have a nutrient management plan and an associated

soil test.
Q. So as a result of that rule, did people in Arkansas end up capturing more plots or more fields than they had been having tested before?
A. Yes, as a result of that rule, as you can see, there were a lot more fields that were sampled.
Q. All right, sir. What was the average STP value for the test results in Benton County in 2006?
A. The average in 2006 was 879 for Benton County and for Washington County, the average was 793.
Q. Would either one of those values be at least ten times the amount of phosphorus that's needed agronomically to grow crops?
A. Yes, they would.
Q. Let's look at exhibit -- excuse me -- 415, if we could. Before we talk about the numbers, Dr. Johnson, would you tell the Court basically what this shows, what this tabulation shows and what the source of the data was?

A. The source of the data was a set of soil test results representing George's and Tyson litter applications or litter applications associated with those or farmers associated with those integrators. And the data in the table is a summary of the results from those soil test reports.

Q. Okay. To your knowledge, were the original data things that have been produced in this case that you reviewed?

A. Yes, they were.

Q. All right, sir. Would you tell the Court, please, what the average -- well, the number of observations you got for phosphorus and what the average STP was?

A. The average STP was 336 and the number of observations was 401.

Q. Would that average of 336 be approximately five times the agronomic need for those samples for phosphorus?

A. Yes, it would.

Q. All right. Let's look at the tabulation in the bottom of the -- at the bottom of that chart. What does it mean when you say number of STP over 65?

A. That's the number of that group of 401 observations that exceeded the soil test P of 65. So there were 353 --

Q. All right, sir.

A. -- that were above that.

Q. And what percentage of those samples exceeded 65 STP?

A. That's 88 percent.

Q. What percentage of those samples were lower than STP 40?

A. 4.7 percent.

Q. All right, sir. Why did you put the STP 40 on there, what's the significance of that?

A. The significance of less than 40 represents those fields

where you would expect to get a fairly significant response from input of phosphorus.

Q. All right, sir, thank you. Let's look, please, at Exhibit

420. Once again generically, Dr. Johnson, would you tell the Court what this exhibit shows and what the source of the data was?

A. The source of the data is the registry from the Arkansas Natural Resources Commission for the year 2007 for Benton County. And the first or the upper portion of this exhibit actually shows how that registry looks when you look at the front page.

Q. All right, sir. Did the original data have more than the Illinois River Watershed in it?

A. Yes, it did.

Q. And did you sort that data to only focus on the Illinois River Watershed entries in it?

A. Yes, I sorted the data to eliminate the data that were not in the Illinois River Watershed. And then I further sorted the data by integrator that was identified in this registry and then I calculated the average STP for each of those integrator groups.

Q. All right, sir. Would you please tell the Court what the average STP level from the entries in the Benton County 2007 registry were for Cargill?

A. For Cargill the average STP was 406.

Q. For Cobb-Vantress?

A. For Cobb the average STP is 424.

Q. George's, please?

A. George's the average is 448.
Q. For Peterson Farms?
A. Peterson Farms is 420.
Q. For Simmons?
A. Simmons is 331.
Q. And for Tyson?
A. Tyson is 433.
Q. All right, sir. Mr. Hammons, if you would put up please No. 418.

Once again, Dr. Johnson, would you tell the Court generically what this document is and what the source of the data for it was?

A. The source of the data came from Oklahoma Department of Agriculture, Food and Forestry. And it represents entries associated with litter spreading, identifying integrators, average soil test values. And in this table, I have identified -- I mean, it didn't give average soil test phosphorus, I calculated that. It gave soil test values. So in this table, I've calculated the average soil test phosphorus levels and identified the number of observations.

Q. All right, sir. For what time period were these samples covering?
A. I believe this is 1996 to 2004.
Q. All right. Would you tell the Court how many observations and what the average STP value for Cobb-Vantress was?

A. The average STP is 310 from 31 observations.
Q. And for George's?
A. Average STP was 18 and there was only one observation.
Q. Honeysuckle White which I believe is a trade name for

Cargill, would you tell that?
A. The average STP was 303 from 23 observations.
Q. For Simmons Foods, sir?
A. Simmons Foods was 271 from 32 observations.
Q. And Tyson Foods, sir?
A. Tyson Foods was 196 from 66 observations.
Q. And Willow Brook Foods, sir?
A. Willow Brook Foods is 157 from 14 observations. And I believe we may have skipped over Peterson Farms.
Q. Well, I would hate to overlook Peterson Farms. What is the value there?
A. It was 128 from 7 observations.
Q. All right, sir. This table down at the bottom, would you tell the Court please what that represents?
A. The table on the bottom is a table that was generated during my deposition by the defense counsel, except I think that I have added the average soil test values for each of those categories, although they may have been included as well.
Q. Okay. So what would be the percentage there of soil test values over this several year period that was below 65?
A. The average soil test P that was below 65 would have

been -- I mean, the average number of samples was 26 samples, 26 percent of the samples. Average soil test P was 30.
Q. Of that group below 65?
A. Of that group less than 65.
Q. What about the group between 65 and 300?
A. That group represented 47 percent of the samples and the average STP was 170.
Q. So the 170 would be not quite three times the STP

necessary?
A. That's right.
Q. All right. What about for those samples over 300, what was the percentage?
A. There were 25, almost 26 percent of the samples that were above an STP of 300. And the average STP for that group was 567.
Q. Dr. Johnson, in the Illinois River Watershed would you, in nature, ever see an STP that high?
A. I don't believe so, no.
Q. Mr. Hammons is about to put up a map, Dr. Johnson, and as he does so, let me ask you to -- first of all, if you would, please, explain the source of this map which we've numbered Exhibit 413 and then we'll talk about what it represents.
A. The map is from a USDA publication called Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients in the U.S.A.

Q. And what was the date of the publication?
A. The date is 2000.
Q. And what was the date of the period of time covered in the map?
A. The period covered in the map is from the 1997 ag census data.
Q. Okay. Mr. Hammons, if you would put 417 up, please. Dr. Johnson, is 417 a summary of the data that comes out of the map and the report that contains it?
A. Yes.
Q. Would you tell the Court, please, what -- summarize that data, please.
A. The summary of this data shows that for the 1997 on-farm

excess manure phosphorus for Washington and Benton Counties in Arkansas, the excess on-farm manure phosphorus was greater than 2 million pounds. For Adair, Cherokee and Delaware Counties in Oklahoma, the excess manure phosphorus was between 500,000 and 2 million pounds, and for Sequoyah County the excess manure phosphorus was 50,000 to 200,000 pounds.

Q. Dr. Johnson, let me ask you, are these values of pounds meaning pounds of litter or pounds of phosphorus?

A. These are pounds of phosphorus. This is not pounds of litter.

Q. Okay. Could you give the Court an estimate of approximately how many pounds of P2O5, for instance, there is

in a ton of litter?

A. There's approximately 70 or more pounds of P2O5 in a ton of litter.

Q. All right.

A. And I'd like to add that this expression of, for example, 2 million pounds of excess phosphorous is expressed as elemental and it's not P2O5. So if you want to put it on a P2O5 basis, you need to multiply times 2.29.

Q. All right, sir. Did you, in the course of your research, have occasion to look at data that has been gathered by the court-supervised project for the Eucha-Spavinaw Watershed?

A. Yes, I did.

Q. And were the STP values that you looked at there derived for purposes of land application of poultry waste?

A. Yes, they were.

Q. Is the Eucha-Spavinaw Watershed contiguous to the Illinois River Watershed?

A. Yes, it is.
Q. It obviously is poultry grown in Eucha-Spavinaw?
A. Yes.
Q. And is its waste land applied there?
A. Yes, it is.
Q. Could you tell the Court what the values you found for the soil test phosphorus values in the adjoining Eucha-Spavinaw Watershed?

A. Yes, for the Arkansas side, the average values were 299, STP value of 299. And the Oklahoma average soil test phosphorus level was approximately, I believe, 148. And that was out of 240 observations, I think, in Arkansas and some less in Oklahoma.
Q. Do you recall what percentage of the STP values in Arkansas were over 65?
A. I believe more than 90 percent were over 65 in Arkansas and I believe in Oklahoma it was 88 percent. I don't have that number in front of me. I brought it with me but I somehow have misplaced it.
Q. I know exactly how that can happen, Doctor.
A. Oh, I just found it.
Q. We've thrown around a lot of numbers. I want to make sure we get the right ones.
A. Let me answer your last question which was the percentage of soil test phosphorus values that were greater than 65 in Arkansas, and that was 96 percent.
Q. All right.
A. In Oklahoma it was 81 percent.
Q. And in Arkansas, what percentage were below the 95 percent sufficiency level of 40 STP?

A. That would be 1.5 percent.
Q. And in Oklahoma what percentage was below that level?
A. 9.3.

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Q. All right, sir. We've talked, Dr. Johnson, about the nutrients, particularly the phosphorus that's in poultry litter, so that we know there are some nutrients there. But let me ask you this. As a general proposition, is poultry waste and poultry litter a good commercial type fertilizer?
A. No, it is not.
Q. Why do you say that, sir?
A. If it were a good fertilizer, it would be in demand by farmers who have identified nutrient deficiencies far away from where the poultry waste is generated and it would be sold by fertilizer retailers.
Q. How does the nutrient value per pound or per ton of poultry litter compare with the nutrient value of commercial fertilizer?
A. It's much, much less.
Q. As a result, does that mean you have to apply or move a larger weight of litter to get the same amount of fertilizer?
A. Yes.
Q. Or nutrient?
A. Yes, you would, yes.
Q. Okay. In your profession, sir, what do you mean when you talk about a soil conditioner or a soil amendment?
A. A soil conditioner or a soil amendment would be a material that could be applied to a soil to correct an existing chemical or physical property that was deficient in providing the

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necessary support for crop production.
Q. Okay. Do you have experience prior to your retirement in reviewing for the Oklahoma Department of Agriculture, Food & Forestry proposed soil amendments that were coming on the market?
A. Yes.
Q. Do you feel like you understand what a soil amendment is and what ODAFF requires of a soil amendment?
A. Yes.
Q. Has anyone ever asked you to evaluate poultry litter as a soil amendment or a soil conditioner?
A. No.
Q. To your knowledge, Dr. Johnson, has anyone asked either you or anyone else at Oklahoma State University to evaluate poultry litter or poultry waste as a soil amendment?
A. No.
Q. Or soil conditioner?
A. No.
Q. Okay. Is, in your view, poultry litter a good soil conditioner or soil amendment?
A. No.
Q. Why not?
A. Well, because in order for it to be a good soil conditioner or amendment, it must have components that will correct a physical or chemical condition that's lacking in the

soil. And while organic matter can be added to soils to improve things like soil tilth and infiltration and moisture-holding capacity, in order for that to be effective, it needs to be incorporated into the soil, into the tillage

depth.
Q. Is it your understanding that typically in the Illinois River Watershed poultry litter is incorporated into the soil or spread on top of the soil?
A. It's my understanding and it's my belief that it is seldom incorporated and most often the traditional application is simply a surface application.
Q. All right, sir. In your business and in your profession is unmanipulated animal manure considered a soil conditioner or a soil amendment?
A. No, it is not.
Q. And as we use these terms, are a soil conditioner and a soil amendment the same thing?
A. I believe so, yes.
Q. Okay. In the testimony that you've given, Dr. Johnson, have you taken any account of the bacterial content of poultry waste as opposed to the nutrients that we've discussed?
A. No.
MR. NANCE: Nothing further, Your Honor, oh, other than to move admission of the exhibits.
THE COURT: Very well. Those exhibits, do they have

numbers?
MR. NANCE: Well, I've just been handed another question which I'll ask and then I'll be done, Judge.
THE COURT: Very well.
Q. (By Mr. Nance) Is there any way that you know of, sir, to apply bacteria for agronomic purposes?
A. No -- yes, there is. In the case of legume production such as alfalfa, it's beneficial to add rhizobium bacteria, the

nitrogen-fixing bacteria.

Q. Are you aware of any other instance besides that?

A. No.

MR. NANCE: Nothing further, Your Honor, other than to move admission of the exhibits.

THE COURT: Would that include each and every one of these exhibits in this packet? I don't believe you touched upon all of them.

MR. NANCE: No, I did not, you're absolutely correct, sir. I can give the clerk the numbers that we'd like to move or I can list them now, if you'd like.

THE COURT: Go ahead and list them, let's get them out of the way. And keeping in mind that the evidentiary standards are somewhat loose in a preliminary injunction. We typically don't admit bios but since we've done it with impunity up until now, we won't stop.

MR. NANCE: Given the time constraints --

THE COURT: 84 is admitted.

MR. NANCE: 91, Your Honor.

THE COURT: Any objection?

MR. MCDANIEL: No, Your honor.

THE COURT: 91 is admitted.

MR. NANCE: 411, sir.

THE COURT: Any objection.

MR. MCDANIEL: None.

THE COURT: 411 is admitted.

MR. NANCE: 412.

THE COURT: Any objection?

MR. MCDANIEL: None.

THE COURT: 412 is admitted.

MR. NANCE: 414.
THE COURT: Any objection?
MR. MCDANIEL: None.
THE COURT: 414 is admitted.
MR. NANCE: 415.
THE COURT: Any objection?
MR. MCDANIEL: None.
THE COURT: 415 is admitted.
MR. NANCE: 420.
THE COURT: Any objection?
MR. MCDANIEL: No objection.
THE COURT: 420 is admitted.

MR. NANCE: 418.
THE COURT: Any objection?
MR. MCDANIEL: No objection.
THE COURT: 418 is admitted.
MR. NANCE: 413 is the map.
THE COURT: Right, any objection?
MR. MCDANIEL: No, Your Honor.
THE COURT: 413 is admitted.
MR. NANCE: And 417 is the summary based on the map.
THE COURT: Any objection?
MR. MCDANIEL: No objection.
THE COURT: 417 is admitted. I believe that's it.
MR. NANCE: Thank you, Your Honor.
THE COURT: Cross-examination.
MR. MCDANIEL: Scott McDaniel for Peterson Farms.
THE COURT: You may inquire, sir.
MR. MCDANIEL: Thank you. The defendants believe

strongly that Your Honor needed another face to look at. And as you can see, we don't have a lot to work with, so my apologies, but at least we'll change the cadence a little bit with my southern accent.

CROSS-EXAMINATION

BY MR. MCDANIEL:

Q. Good afternoon, Dr. Johnson. Good to see you again.

A. Good to see you.

Q. Let's start, sir, in a nutshell your opinion is this: You don't believe that anyone should be allowed to use poultry litter on pastures in the Illinois River Watershed if the soil in the Illinois Watershed tests at 65 soil test phosphorus or higher; right?

A. That's in a nutshell correct. I don't believe there's any phosphorus benefit to the application of poultry litter in the IRW when the soil test P is above 65.

Q. As a consequence of that opinion, you believe that all the litter in the Illinois River Watershed should be removed and not used in the watershed; correct?

A. Yes.

Q. All right. You've told this Court that land applying poultry litter on lands in the Illinois River Watershed when the STP is 65 or higher is waste disposal; right?

A. I believe that's what the practice has been, yes.

Q. All right. Do you believe that if you use poultry litter on pastures and the soil test phosphorus is below 65, the STP, is that waste disposal in your opinion?

A. I believe that you could get some benefit from the phosphorus in the litter in those cases.

Q. All right. My question is, if the soil test phosphorus is

below 65, do you believe that is disposal of a waste or not?
A. I don't believe you can determine whether it's disposal of waste or not in that situation.

Q. Well, what is your criteria?
A. My criteria is that when the soil test phosphorus is above 65, there's no agronomic benefit -- phosphorus agronomic benefit from applying that litter.
Q. So if it's below 65, you can't provide this Court any criteria as to what would be disposal or what wouldn't be?
A. That's right. You could have a fertilizer benefit if it's below 65.
Q. Well, now, you've said several times in your direct examination that if the soil test phosphorus was 65 STP, that using poultry litter would not provide any agronomic benefit for phosphorus.
A. That's correct.
Q. Right?
A. That's correct.
Q. All right. Your criteria that your opinion is based upon is only related to the agronomic need for one macronutrient and that is phosphorus?
A. That's correct.
Q. No other element or constituent in poultry litter is an element of your opinion; correct, your criteria?
A. That's generally correct, yes.
Q. So even -- now, tell me this, Dr. Johnson, if the soil in a pasture in the Illinois River Watershed is at 65 STP, would you agree that poultry litter could still improve the yield of

the pasture grasses on that pasture if there's an additional need for nitrogen?

A. If an additional need for nitrogen has been identified through a soil test and through practice, then there could be an additional benefit from the nitrogen.

Q. You could improve the yield?

A. You could improve the yield.

Q. And yield for common usage, that means you can get more grass per acre, is that a fair way --

A. That's correct, you could.

Q. So if you are grazing that pasture, you could graze more cattle on an acre if your yield is better, would you agree?

A. Yes, you could. If you had identified that there was a nitrogen deficiency in the soil, that would not meet the yield potential for that pasture forage.

Q. And if you were cutting hay on that field, you could get more bales or more tons of hay per acre because of that boosted yield, do you agree?

A. If you had identified a nitrogen deficiency.

Q. Well, that was the premise of my question.

A. Yes, I just want to make sure that we're clear that that always is there.

Q. Well, and that same series of questions, Dr. Johnson, if the field is at 65 STP but there's a recognized by soil test deficiency for potassium, you could improve the yield of the

grasses on that pasture with poultry litter, even if it's 65 STP, do you agree?

A. Yes.

Q. Now, the nitrogen, phosphorus and potassium in litter,

those are what we call macronutrients.
A. Yes.
Q. Do you agree with that?
A. Yes.
Q. What is a micronutrient?
A. A micronutrient is another essential nutrient or group of essential nutrients that plants cannot complete their life cycle without but for which the requirement is much lower in total amount.
Q. All right. You said a plant needs these in order to, you said complete its life cycle?
A. Yes.
Q. All right. Tell me what micronutrients typically can be found in poultry litter.
A. All the micronutrients can typically be found in poultry litter and that would include iron, manganese, copper, zinc, boron, chlorine and molybdenum
Q. Now, you said -- I believe you answered a question that poultry litter cannot be customized, custom blended to fit a particular crop, so to speak?
A. Yes.

Q. So you have to agree it's a whole commodity in and of itself, take it or leave it. You either got to use it all or you use none of it. You can't put down potassium and not put down nitrogen. You can't put down zinc, but not put down phosphorus?
A. That's true.
Q. Right?
A. That's true.

Q. You just use it.
A. You get it all.
Q. You get it all, that's right.
A. Whether you need it or not.
Q. So if the soil in a pasture had sufficient zinc, one of the micronutrients you mentioned, had sufficient zinc, but it needed phosphorus or it needed nitrogen, would you still accuse that farmer of disposing of poultry litter if he uses it on that field?
A. If he uses it on the field to correct a phosphorus deficiency?
Q. Right.
A. There would not be a problem with that practice if it were practiced as it is with commercial fertilizer.
Q. I didn't ask you about commercial fertilizer.
A. I understand that.
Q. You understood my question was --

A. Yes.
Q. -- that we're assuming that that soil is completely sufficient to meet the need of the micronutrient zinc?
A. Yes.
Q. But the soil test shows it needs nitrogen and it needs phosphorus. Putting poultry litter on that field, that's not waste disposal, is it?
A. No.
Q. All right.
A. It may not be.
Q. In fact, Dr. Johnson, you cannot tell this Court that forages receive no benefits whatsoever when poultry litter is utilized in the soils at 65 STP; right?

A. I can tell the Court that there's no phosphorus benefit to the forage --

Q. All right. That wasn't my question.

A. -- when poultry litter is applied. And that for the most part, the other nutrients are either adequate or have not been tested to determine their deficiency.

Q. Dr. Johnson --

A. And so then I would say no.

Q. All right. I need you to listen to my question and answer my question.

A. Okay. I will.

Q. You cannot tell this Court that forages do not receive any

benefit from the use of poultry litter if the soil is at 65 STP; is that correct?

A. You'd have to identify what you mean by benefit to me.

Q. Improved yield.

A. I don't know whether that would happen or not.

Q. The question is you cannot categorically tell this Court that if you put poultry litter on a pasture that is already at 65 STP that there will be no benefit. You cannot make that categorical statement, can you?

A. That's true.

Q. And you're not aware of any published study that would state that the litter application rates that are typically used in the Illinois River Watershed would actually harm the yield of pasture grasses?

A. That's true.

Q. Now, you do understand that the preliminary injunction motion that's been filed by the plaintiffs in this case, it's

based on this notion or this allegation that poultry litter is somehow causing contamination of the waters of the state from pathogenic bacteria. Do you understand that about this motion?

A. Yes.

Q. All right. You have to agree that the opinions you're offering, Dr. Johnson, have really nothing to do with that question; right?

A. That's correct.

Q. You've not determined whether the rate of poultry litter application affects the amount of bacteria that may be released from any field to the waters of the state, you don't know that?

A. That's true.

Q. You're not aware of anyone working for the State who's done that analysis either; right?

A. I'm not aware of that. I don't know that part of the case.

Q. Isn't it true, Dr. Johnson, that the soil test P on a field that receives poultry litter has absolutely nothing to do with whether or not there are viable bacteria lying in the litter on the field or the potential for that bacteria to reach any waters of the state?

A. That's true, the soil test P is simply a chemical measurement.

Q. Thus your opinions about how much phosphorus is already in the soil of a pasture offers this Court absolutely nothing to use in its decision as to whether or not the plaintiffs have proven that these pastures receiving litter are, in fact, sources of pathogenic bacteria to the waters of the state?

A. I'm not sure that I followed your whole question --

THE COURT: Mr. McDaniel, I don't --

A. -- I think that's really a long question.
THE COURT: Excuse me. I'm not sure that we need to go -- I think I'm relatively clear now. I had a discussion

with Mr. Baker and Mr. Jorgensen yesterday about the State's position, and I think I understand it. It's relevant to the extent that we're asking the question is the application of poultry litter on pastures waste or disposal rather, the word is disposal in the regs; correct? I mean, this witness doesn't have anything to do with bacteria.
MR. MCDANIEL: Right.
THE COURT: I understand that. This goes just entirely to really the legal issue of whether it's waste; right, Mr. Baker?
MR. BAKER: That would be its relevance, Your Honor.
THE COURT: Right.
MR. MCDANIEL: Well, the scientific point, and it's apparent that the Court is --
THE COURT: I didn't appreciate the point yesterday until I talked to Mr. Jorgensen and Mr. Baker and Mr. Baker clarified the State's position but I understand it. This witness really doesn't have anything to do with bacteriological agents. He's just -- his testimony is necessary with regard to a necessary legal issue that we have to address; right?
MR. MCDANIEL: That's true, and I want to make sure that it's not lost on the Court that the imminent and substantial endangerment alleged here doesn't have anything to do with phosphorus.
THE COURT: Doesn't have anything to do with

phosphorous, I agree. I understand. You've gone through the old NPK, the macronutrients, right, Doctor?

THE WITNESS: Yes.

THE COURT: Well, my brother got a master's degree at your institution in agronomy, so he taught me a few things. But I don't think we need to follow that line anymore.

MR. MCDANIEL: I just wanted to explore that disconnect and make sure the Court understood, at least from this soil scientist, that whether or not a field was 65 STP had no relevance to whether or not it could be a source of pathogens.

THE COURT: I fully understand.

MR. MCDANIEL: Very good, thank you. Well, I'll move on then.

Q. (By Mr. McDaniel) All right. Dr. Johnson, nonetheless, you are offering an opinion to this Court that it should adopt an absolute waste disposal threshold of 65 STP in the Illinois River Watershed, do you agree?

A. Yes.

Q. All right. Despite the fact that you're offering an opinion that the management scheme for using poultry litter in the Illinois River Watershed should be changed, it is true nonetheless, Dr. Johnson, that you really are not knowledgeable about the specific elements of the two states' regulatory programs that are in force in the Illinois River Watershed;

right?

A. I have some familiarity with them.

Q. But you don't know the details of those programs, do you?

A. The legal details, no.

Q. In fact, you're not aware that the laws of Oklahoma and Arkansas specify the allowable rates, timing and location at which poultry litter can be applied to specific lands in the Illinois River Watershed?

A. I am aware of that.

Q. All right. Did you learn that since the deposition that I took or did you learn it at the deposition?

A. I learned some of it at the deposition.

Q. All right. Fair enough.

A. And as I pointed out in the deposition, even though those rates are allowed, they're not required.

Q. Right, but I just would like the Court to recognize that we're not only trying to represent our clients, we're trying to serve the public here, Your Honor, and spread the light as far as we can. If it's in a deposition, then we're proud to do that.

Now, prior to your deposition, you'd never reviewed the regulations issued by ODAFF covering poultry feeding operations in the Illinois River Watershed; right?

A. I may have reviewed it, but it wasn't -- I wasn't very familiar with it. It's been a long time since I'd read it, if

I did read it, and I believe I had read it.

Q. You've never prepared an animal waste management plan or a nutrient management plan?

A. No.

Q. You're not trained or certified in the preparation of animal waste management plans or nutrient management plans?

A. I've provided training for people who are.

Q. But you're not --

A. But I'm not.
Q. You're not certified?
A. That's true.
Q. You may have taught a module at a class for plan writers, that's about it?
A. I may have. In fact, I taught the nutrient management portion of the class, yes.
Q. But you don't claim any familiarity with the specific components of an animal waste management plan?
A. That's true.
Q. In preparing your opinions in this case, you did not review a single animal waste management plan from the Illinois River Watershed; right?
A. I don't know if that's true or not. I have had occasion to look at one or two, and I don't know if they represented the Eucha-Spavinaw or the IRW.
Q. There was no concerted effort on your part to gain any

understanding of the animal waste management plans that were being used in the Illinois River Watershed in forming your opinions; right?
A. Yes, that's right.
Q. Now, despite your lack of detailed knowledge of the regulatory programs in place in the Illinois River Watershed, it's your opinion, isn't it, Dr. Johnson, that the laws of Oklahoma and Arkansas should be changed to employ this absolute threshold that you are proposing to the Court?
MR. NANCE: Objection as irrelevant, Your Honor.
A. I believe you asked the same question in my deposition --
THE COURT: I'm sorry, just one second, let me go over that question. I'd like to know the answer. Overruled.

A. I believe my response in deposition was that to the extent the laws provide excessive waste application that will result in increased risk of pollution of the surface waters of the state, I believe they ought to be changed.

Q. (By Mr. McDaniel) And your understanding -- or do you understand, Dr. Johnson, that currently the law in both Oklahoma and Arkansas in the Illinois River Watershed does not employ the strict 65 STP threshold that you're asking this Court to adopt?

A. That's correct.

MR. NANCE: Objection, calls for a legal conclusion.

THE COURT: Overruled.

A. That's correct, it allows for that application of excessive waste application, but it doesn't require it.

Q. (By Mr. McDaniel) Okay. So you are advocating to this Court by adopting your rule to actually change the law of the two states in the watershed; right?

A. I'm suggesting that to the extent that the existing laws promote excessive waste application to the detriment of the surface waters, they ought to be changed.

Q. Can you give me a yes or no answer to my question?

A. I don't think so.

Q. Well --

THE COURT: I think we've plowed this ground.

MR. MCDANIEL: Thank you, Your Honor.

THE COURT: No pun intended.

Q. (By Mr. McDaniel) Let's look at exhibit Defendants' Preliminary Injunction Exhibit No. 4, and it should come up before you, Dr. Johnson, on the screen.

MR. MCDANIEL: If I can approach the witness, please, Your Honor?

THE COURT: You may.

Q. (By Mr. McDaniel) Dr. Johnson, if you need to see the full documents, they're in this folder.

A. That would be great.

Q. Whatever is your preference.

A. Do you know where it is in this folder?

Q. There you go.

A. Okay.

THE COURT: Mr. McDaniel, let me ask Mr. Baker here to see if I under the State's position correctly, but the objection, I take it, came from the Plaintiffs' side because the plaintiff takes the position that notwithstanding the rates allowed by state agencies, the federal statute and regulations may classify this as waste and therefore ought to be enjoined, is that the State's position?

MR. NANCE: Yes, sir.

THE COURT: Okay, thank you. I just wanted to make sure I understood that.

MR. EDMONDSON: That's part of it. The other part is the same state regulations that provide load limits also provide that in no event shall it result in any discharge to the waters. It's the same set of regulations.

THE COURT: Thank you. Mr. McDaniel.

MR. MCDANIEL: And I didn't perceive Your Honor as inviting me to argue that point so I --

THE COURT: You certainly may. To the extent that I asked the plaintiff to clarify for me its position, you certainly may, sir.

MR. MCDANIEL: Your Honor, if it's all right, I would prefer to defer that for a time when the Court wants to hear argument and go ahead and get through with this witness, if

that's all right.

THE COURT: That would be fine.

MR. MCDANIEL: Thank you.

Q. (By Mr. McDaniel) All right. Dr. Johnson, we put up which is Defendants' Exhibit No. 4. Would you tell the Court what that is, please?

A. That's the Natural Resource Conservation Service nutrient management Code 590 document.

Q. All right. You agree that this is a standard developed by the United States Department of Agriculture Natural Resources Conservation Service for Oklahoma that provides the requirements for animal waste management plans written for Oklahoma poultry growers?

A. I believe that's true, yes.

Q. All right. Let's flip over to page 4. And Ms. Ferguson is going to, on the screen, focus in on the section that refers to phosphorus application. Do you see the bullet point that says phosphorus application?

A. Yes.

Q. And the Code 590 says for the application of phosphorus, the maximum planned rates of phosphorus application shall be determined using the Oklahoma Phosphorus Assessment Worksheet and then Tables 8 and 9. Do you see that, sir?

A. Yes, I see that.

Q. All right. Let's flip over to page 20 of Exhibit 4. Page

20 is entitled the Oklahoma Phosphorus Assessment Worksheet. Do you see that?
A. Yes.
Q. All right. Now, you've never actually used one of these, have you?
A. Used it in what sense?
Q. You've never filled one of these out and completed one of these for a pasture?
A. No.
Q. All right. Now, you agree that under the Code 590 which is part of the Oklahoma law, the nutrient plan writer is required to fill one of these out for each field where poultry litter may be land applied, do you agree?
A. I don't know if that's the case or not.
Q. You don't know if that's the law?
A. Well, I'm not familiar with the law.
Q. Do you agree that this -- I thought we agreed this Code 590 applies to animal waste management plans for poultry growers in Oklahoma?
A. Yes, I think that's probably true. Whether it's the law or not, I don't know.
Q. Oh, you don't know whether the Code 590 is the law of Oklahoma?
A. That's true. I think you told me it was, so I think it probably is.

Q. You prefer not to trust me on that?
A. No.
Q. Let's look at the Oklahoma Phosphorus Assessment Worksheet. You do agree that a nutrient plan writer who's

preparing an animal waste management plan for an Oklahoma poultry grower in the Illinois River Watershed should fill one of these sheets out for each field?

A. Yes, and particularly as it relates to the use of animal waste and that's what this is. Because of the higher risk for pollution resulting from animal waste applied to the fields, you must have these additional requirements.

Q. Each one of these sheets should be filled out for each individual field to take into account field-specific physical characteristics, do you agree?

A. I expect they should, yes.

Q. All right. Let's look at the sheet and look at some of the criteria that planners are supposed to use. The planner is supposed to include the soil test phosphorus?

A. Yes.

Q. That's what we've talked about quite a bit this afternoon, isn't it?

A. Yes.

Q. Supposed to consider how it's put on the ground, the application method; right?

A. Yes.

Q. Supposed to consider the slope of the land?

A. Yes.

Q. Supposed to consider the potential for erosion of the land?

A. Yes.

Q. Supposed to consider the frequency of flooding?

A. Yes.

Q. The planner is supposed to consider the distance of the

application to streams, ponds, wells and sink holes. Do you see that?

A. Yes.

Q. Do you see these criteria here?

A. Yes, I do.

Q. A hundred feet from a stream, pond, well, 300 feet from every drinking water well. Next one down, distance to a stream, it's defined; correct?

A. Yes.

Q. It can be altered if there is a buffer in place; right?

A. I believe that's true.

Q. All right, and then depth of soil, that's another criteria?

A. Yes.

Q. It has to be at least 10 inches of soil in order to use poultry litter; correct?

A. Yes.

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Q. And also how rocky the soil is is a factor the planner should consider; correct?

A. Yes.

Q. Were you here earlier this afternoon as Dr. Fisher was talking about the characteristics of the soil in the Illinois River Watershed?

A. Yes.

Q. And he was talking about how some places it's rocky?

A. Yes.

Q. All right. That's something a nutrient management planner is supposed to observe and take note of in preparing the phosphorus assessment worksheet, do you agree?

A. Yes.

Q. Now, the criteria that you are asking this Court to adopt is only the very first one I mentioned, that's soil test phosphorus; right?
A. Yes.
Q. All these other criteria, you would agree, Dr. Johnson, relate to the potential for phosphorus to move from that land application site into a water course?
A. If you are applying animal manure, yes.
Q. Now, let's look back. We're still in Code 590. Would you look at page 4, sir. Tell me when you are there.
A. Yes.
Q. It should be up on the screen. The left column, Dr.

Johnson, set out by the NRCS under these bullet points are a number of physical conditions on an individual field which, if they are present, you cannot use poultry litter, do you agree?
A. Yes, I think we just went over each of these.
Q. Right. In other words, that slope factor, if it's over 15 percent slope, no litter; right?
A. That's correct.
Q. If there's less than 10 inches of soil, no litter; right?
A. That's correct.
Q. Okay. We're not going to go through the list, but I just want to point out for the Court's benefit that there's a number of items listed here.
A. Yes.
Q. Now, in order to make use of poultry litter in the Illinois River Watershed, I believe the Code 590 told us to look at Table 9. Do you remember that?
A. Yes.

Q. Let's look at page 21. Tell the Court what Table 9 is.
A. Table 9 is a table that shows -- it's titled animal manure application rates for non-nutrient -- I'm sorry, wrong table, that's Table 8. Table 9 is annual manure application rates for nutrient limited waters. And it shows the soil test values -- a range of soil test values from zero to greater than 300 related to application rates associated with soil depth and percent slope. It also shows those in relationship to the size

of rocks and the soil covered by rocks.
Q. All right. On this Table 9, sir, has the soil test phosphorus as one of the columns?
A. Yes.
Q. And you would agree, sir, that the legal maximum here in the Code 590 is 300 STP, not the 65 you propose?
A. Yes.
MR. NANCE: I object as calling for a legal conclusion, Judge.
THE COURT: I think he's just asking a factual bit of information there. Overruled.
A. What you stated is what is found on this table.
Q. (By Mr. McDaniel) Thank you. Now, let's go back to the very beginning, sir. Page 1 of the document --
A. Yes.
Q. -- PI Exhibit 4. Now, just to circle back, you made the statement that putting poultry litter down anywhere at 65 STP above amounts to waste disposal?
A. Yes.
Q. But let's look here under the purposes on page 1 of the code. It says the purposes of the nutrient management code are to budget and supply nutrients for plant production; right?

A. Yes.
Q. To properly utilize manure or organic byproducts as a plant nutrient source; right?

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A. Yes.
Q. To minimize agricultural non-point source pollution of surface and groundwater resources. Do you agree?
A. Yes.
Q. To protect air quality by reducing nitrogen emissions and the formation of atmospheric particulates; right?
A. Yes.
Q. The last one is to maintain or improve the physical and chemical and biological condition of soil; is that right?
A. Yes.
Q. All right, sir. Is the word disposal mentioned there anywhere?
A. No.
Q. It says to properly utilize animal nutrients. That's the NRCS' language, isn't it?
A. Yes, and I would like to add that it also says as one of those bullets to minimize agricultural non-point source pollution of surface and groundwater resources. And that the scientific literature has many studies that conclude as soil test phosphorus levels increase, the water soluble phosphorus in field runoff increases proportionately. So to the extent that this objective is being attempted to be carried out, Table 9 doesn't do it.
Q. Oh, I see. You don't think the NRCS is accomplishing its mission in Oklahoma?

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A. There's a contradiction between this objective and the excessive application of poultry litter when the soil test phosphorus is above 65.
Q. Now, isn't it true, Dr. Johnson, that you've actually gone to the NRCS and told them their code is wrong? That's true, isn't it?
A. That's true. Well, I don't know if I told them it was wrong.
Q. Excuse me?
A. I don't know if I told them it was wrong. I told them at the time as they were seeking input that there wasn't any sound scientific rationale or basis for having soil test levels higher for animal waste than for fertilizer.
Q. You told them that when you were working at --
A. Yes.
Q. -- Oklahoma State University?
A. Yes.
Q. And they didn't change the code, did they?
A. They didn't.
Q. Let's go to Exhibit No. 6, Defendants' 6, please. It should be in your packet. Can you identify for the Court what Exhibit 6 is, Dr. Johnson? It's also on the screen, if it will help you, sir.
A. Okay. I see it on the screen, I don't see it in here. It's an animal waste management plan.

Q. Do you recall looking at this at your deposition?
A. Yes, I do.
Q. All right. It's the animal waste management plan for a W.A. Saunders in Delaware County, Oklahoma?

A. Yes.
Q. Who was it prepared by?
A. It's dated September 14th of 2005.
Q. You need to speak in your microphone, if you wouldn't mind, sir.
A. I'm sorry. It's dated September 14th, 2005. I don't see the location of who it's prepared for.
Q. All right. Do you see where it says Oklahoma Department of Agriculture, Food and Forestry?
A. Yes.
Q. Do you see where it has the stamp on it from the Agricultural Environmental Management Services, State Department of Agriculture?
A. Yes.
Q. Let's turn over to the third page of the exhibit. The Bates number on it is -- the last three digits are 181.
MR. BULLOCK: Could we give Dr. Johnson a copy of it so he can actually look at it?
MR. MCDANIEL: It's right in front of him.
MR. BULLOCK: I just wanted to be sure he had it. Thank you, counsel.

A. It's this one.
Q. (By Mr. McDaniel) The third page of the exhibit, Doctor, let me know when you are there please.
A. I'm there.
Q. Let's look at the introduction. About the middle of the introduction, you see, Dr. Johnson, where it says, quote, "The law requires that the Natural Resources Conservation Service, NRCS, recommendation for poultry litter application rates be

followed," closed quote. Do you see that?

A. I see that and I believe that's a misquote.

Q. So the Department of Agriculture is wrong, too?

A. No, I believe that the NRCS does not make recommendations for litter application.

Q. Oh, so you don't think this is referring to the Code 590?

A. It is referring to the Code 590, but the Code 590 is not a recommendation chart.

Q. Okay. You disagree with the characterization of what the Code 590 does?

A. I disagree with the way it's characterized here as providing recommendations.

Q. Okay. Have you taken that up with the Department of Agriculture?

A. No.

Q. All right. Let's look at the description of the property, Mr. Saunders' property on the first line of Section B.

A. Okay.

Q. Do you see where the plan writer says this farm is located in the area of highly vulnerable groundwater?

A. Yes.

Q. So you would agree that this is something that the plan writer is to take into consideration in preparing this animal waste management plan for the Saunders Farm?

A. I agree that it appears on this plan. I mean, I'm reading what you are reading.

Q. All right. Let's look at the -- flip over one more page. It's page 4 of the exhibit. The Bates number ends with 182. And if you could -- where it says application rates, do you see a table there, Dr. Johnson, where it appears that Mr. Saunders

has six field, five of them have been tested?
A. Yes.
Q. And Field 3, let's zoom in on Field 3 right there if you could. Field 3 has tested at an STP of 65; do you agree?
A. Yes.
Q. Now, under your threshold that field could not receive poultry litter; right?
A. Under my testimony, that field would not receive poultry litter to benefit from phosphorus, that's correct.
Q. All right, and you qualified it as to benefit from phosphorus?
A. That's correct.

Q. Let's look at page 14 of the exhibit. The Bates number ends with 192, it's a soil test report. Are you there, sir?
A. Yes.
MR. NANCE: What page, counsel? I'm sorry.
MR. MCDANIEL: It is Bates No. 192.
Q. (By Mr. McDaniel) This OSU lab report, is this the lab that you were in charge of for some period of time?
A. Yes.
Q. All right. Would you agree that this is a soil test report for Field No. 3 at Mr. Saunders' farm?
A. Yes.
Q. It shows that the soil test phosphorus was 65?
A. Yes.
Q. Agree? Now, let's go down for the interpretation and requirements. Is this what you were saying, Dr. Johnson, when you said if there was a recognized need for a nutrient, this is where I'd look to find that?

A. Yes.
Q. All right. What does it say about phosphorus on this field?
A. It says phosphorus is adequate.
Q. What does it say about nitrogen on this field?
A. Deficient.
Q. Now, it's deficient for nitrogen. You agree that poultry litter could help meet that need; right?

A. Yes, yes.
Q. So you would agree -- let's look back at page 4 that lists all the fields. It's Bates No. 182. So we've got Field 3 that even though it's got 65 STP, it needs nitrogen and can benefit from poultry litter. I think you just agreed to that?
A. Yes.
Q. There are four other fields. Would you agree with me, sir, that based upon the soil tests all four of those fields are deficient in phosphorus?
A. Yes.
Q. So they can benefit from the use of phosphorus?
A. That's correct.
Q. Or excuse me -- from poultry litter?
A. Yes.
Q. Let me restate the question. Would you agree that all four of those fields would benefit from the use of poultry litter?
A. They could.
Q. All right. Now, if this Court enters an injunction as requested banning the use of litter, you'd have to agree with me, Dr. Johnson, that Mr. Saunders would not be able to use his free poultry litter to fertilize these four fields even though

you agree that it would be appropriate even under your 65 STP threshold?

A. If these same soil conditions existed today, three years

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after -- or almost three years since they were first sampled, then I would agree. It's my opinion that when poultry litter is used, these deficiencies are quickly corrected and, in fact, exceeded. And so to say whether or not this land could benefit from poultry litter today, I can't say that it would. In fact, I would expect that it would not.

Q. All right. Let me -- let's restate the question. Assume for me that these are the current soil test conditions on this farm.

A. Yes.

Q. Then you would agree that he could benefit from poultry litter on all five of his fields, but if this injunction is entered, he cannot use litter on any of those fields?

A. I would agree with you, yes.

Q. All right. Are you aware of any evidence that Mr. Saunders' use of poultry litter has polluted any of the waters of the State of Oklahoma with phosphorus?

A. No.

Q. Now, let's talk about the soil samples you discussed with Mr. Nance that you used to arrive at your opinions. You admit that you do not have sufficient soil samples from the Illinois River Watershed in order to conduct your analysis, that's why you looked at soil samples from the Eucha-Spavinaw; right?

A. I looked at all sources of soil samples for that part of the state associated with the disposal of poultry waste.

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Q. But you agree that you did not have sufficient soil samples from the Illinois River Watershed to enable you to form your opinion, that's why you looked at soil samples from another watershed?
A. No.
Q. You didn't agree with that?
A. No, I don't agree with that.
MR. BULLOCK: Could I inquire as to how much longer counsel's examination is?
MR. MCDANIEL: Maybe 20 minutes, Your Honor. We lost a little time arguing when I wasn't examining.
MR. BULLOCK: I think we lost two minutes.
MR. MCDANIEL: Understood, but I'm trying to be maybe 15 minutes.
THE COURT: Well, we'll just add it on to the Plaintiffs' time. Go ahead, Mr. McDaniel.
MR. MCDANIEL: All right, thank you.
Q. (By Mr. McDaniel) Let's make something clear for the Judge and for me, too. When -- how many pounds of phosphate do you have to put down to raise the soil STP one notch?
A. It depends upon the soil type or soil texture, but generally it takes about 10 pounds of P2O5 to raise the soil test phosphorus one unit. That would apply in a coarse textured soil. In fine textured soils, clay soils, it might take as much as 15.

Q. Now, these soil samples that you looked at from the Eucha-Spavinaw Watershed that you based your opinions on, you assumed that those soil phosphorus levels in the Illinois River Watershed could be accurately represented by the sampling from

the Eucha-Spavinaw; is that right?
A. Yes.
Q. All right, but you didn't make any real comparisons between the Eucha-Spavinaw Watershed and the Illinois Watershed?
A. Well, to the extent that I have compared the Eucha-Spavinaw Watershed soil test results to the ones from the Arkansas Natural Resources Commission, that comparison does exist.
Q. But you didn't compare the physical environments of the two watersheds?
A. No.
Q. You didn't compare the amount of pasture acreage between them?
A. No.
Q. You didn't compare the acreage receiving litter in each watershed?
A. No.
Q. You didn't compare the acreage of pasture as a function of how much litter is produced in the watershed?
A. No.

Q. But you assumed that they were going to be the same as the Illinois River Watershed soil samples?
A. To my knowledge, the agriculture in the two watersheds is very similar.
Q. Well, I'm not asking you about the agriculture, I'm asking you about soil science.
A. And I'm talking about soil test phosphorus which is a part of the agriculture.

Q. But you haven't made any physical comparisons, you're just simply making assumptions?
A. I'm making comparisons of the data.
Q. The Exhibit 415, Plaintiffs' Demonstrative 415 that's been shown, had some soil samples that you said you attributed to Tyson and George's. Do you recall that?
A. Yes.
Q. In fact, the lands where these samples were taken, you don't know who owns that land, do you?
A. Well, the names were on the soil test reports.
Q. But you don't know whose land it was?
A. But I don't know who owns them. They were identified with these integrators.
Q. All right. You don't know who applied poultry litter on those lands, if anybody; right?
A. That's true.
Q. You don't know the histories of those lands?

A. That's true.
Q. You don't know if it's had commercial fertilizer?
A. That's true.
Q. You don't know if there's been sewage biosolids?
A. That's true.
Q. In fact, Dr. Johnson, isn't it true that you do not have personal knowledge that any of the defendants in this lawsuit actually land applied poultry litter in the Illinois River Watershed?
A. That's true.
Q. Now, these two, these George's and Tyson lands, you can't tell me what percentage of the pastureland in the Illinois River Watershed are represented by those samples?

A. No.
Q. It's infinitesimal, isn't it?
A. I can't tell you what it is.
Q. It's small, isn't it?
A. I don't know that it's small. I didn't do an accumulation of acreages represented by those samples and compare it to the acreage in the watershed.
Q. And you can't state that it's representative of the watershed, can you?
A. No.
Q. Now, the soil samples, your master database that you showed the big spreadsheet and the averages you did, fact of

the matter is you have -- do not know which of those samples were taken in this watershed or taken in another watershed. You only know what county it came from; right?
A. For some of those soil tests. For some of them we know it came from the Illinois River Watershed.
Q. But for the bulk of them used in your average, you have to acknowledge your average in soil samples, that some may be in the watershed, some may be outside the watershed, you don't know?
A. For those that aren't identified within the watershed, then we don't know that they're in the watershed.
Q. For all those soil samples, you do not know the history of the lands; right?
A. That's true.
Q. You don't know whether they've had poultry litter or commercial fertilizer?
A. It's my scientific judgment that those have had poultry

litter.
Q. But it's a judgment without --
A. And the basis for that is that in the thousands of samples that I reviewed that went through the soil testing laboratory where the predominant source of nutrient input was commercial fertilizer, I never saw any numbers that came remotely close to the elevated levels that are represented in these exhibits.
Q. All right. That's your opinion, sir, but you have not

seen any records related to these properties to indicate specifically what went on the ground there?
A. That's true.
Q. As it relates to the soil samples in the fields you've testified about, you cannot identify for the Court a single poultry litter application on one of those fields that's resulted in pollution of the waters in the State of Oklahoma?
A. That's true.
Q. Now, you can't state to this Court how many of these fields where the sampling data came from already cannot receive poultry litter as a consequence of the function of the laws in Oklahoma or Arkansas?
A. Would you restate that, please?
Q. Sure. There are a number of the fields that you evaluated can't receive poultry litter under the current state of the law. Do you agree?
A. That's correct, yes.
Q. Did you go through and summarize how many of those fields already are off the table, so to speak?
A. No.
Q. So regardless of the decision this Court makes, those fields are not going to receive litter. Do you agree?

A. Well, I'd hope they don't.
Q. So when you told the Judge about these high phosphorus levels and averages, you didn't tell him you were including

fields that already cannot receive litter?
A. That's true, but I would add that the reason these samples were taken was for the intent of applying animal waste.
Q. And when 2006 came and there was a spike in the number of samples, it's because of that new regulatory program went into place in Arkansas, right?
A. Yes.
Q. And if all those people went out and took those samples and sent them in and the results came back high, what was that going to mean to those landowners? It was going to mean they couldn't use litter; right?
A. That's correct.
Q. Now, specifically for the Illinois River Watershed, you can't give this Court a number of fields or a number better of farmers like Mr. Saunders who need poultry litter to fertilize their fields but who will be prohibited from doing so if the litter use is banned?
A. That's correct.
Q. You'd have to agree that a total litter ban as requested by the plaintiffs is going to hurt farmers who could use that litter, even under your strict 65 STP standard?
A. I think that would be very limited.
Q. It's going to happen though, isn't it?
A. I don't know that it's going to happen.
Q. You haven't quantified it, can you?

A. No.
Q. You cannot tell this Court how many fields or how many farmers are going to get hurt under your standard?
A. No, by my standard I believe that there would be few exceptions where the not having litter applied would cause any hardship.
Q. Sir, you have not quantified that for this Court, have you?
A. I've quantified it to the extent I've shown that, you know, less than 2 percent of the fields sampled in the year 2006 for Benton and Washington Counties in Arkansas would benefit from any input of phosphorus fertilizer.
Q. The -- let's look at Exhibit 1, please. Let's just look at the cover page. Tell me what Exhibit 1 is, Dr. Johnson.
A. It's titled Title 22 Rules Governing the Arkansas Soil Nutrient and Poultry Litter Application and Management Program.
Q. All right. It's the Arkansas rules that govern the use of nutrients in the Illinois River Watershed. Do you agree?
A. It says soil nutrient and poultry litter application.
Q. All right. This came from your file, do you see that down at the bottom?
A. Yes.
Q. The -- so that means you've read this; right?
A. Well, I've looked at it and I've read certainly parts of it.

Q. Do you agree that in Arkansas, in the Illinois River Watershed in Arkansas, Arkansas law requires the use of what's called the Arkansas PI, phosphorus index?
MR. NANCE: Judge, I object as calling for a legal

conclusion that's beyond the scope of this witness' knowledge or the scope of direct.

THE COURT: Sustained.

Q. (By Mr. McDaniel) Dr. Johnson, are you familiar with the Arkansas phosphorus index?

A. Yes.

Q. All right. Let's look at Exhibit No. 2. Would you agree that this is the Arkansas phosphorus index?

A. Well, this is a manuscript that describes the Arkansas phosphorus index, yes.

Q. Let's go back to Exhibit 1 then which are the rules. Let's look at page 4 of the exhibit under definitions, Section 2201.4B. Let me know when you are there.

A. I'm there.

Q. All right. What does it say the Arkansas phosphorus index is?

A. You want me to read that bullet or Paragraph B?

Q. I'll read it. It says, "means the risk based assessment tool referenced in nutrient management plans developed to govern the terms and conditions under which nutrients may be land applied." And then it says, "See DeLaune, Moore, Carman,

Daniel and Sharpley, the development and validation of a phosphorus index for pastures, fertilized with animal manure." Do you see that?

A. Yes.

Q. That's what I've handed you as Exhibit 2, isn't it?

A. That's correct.

Q. Now, you know who Dr. Sharpley is; right?

A. Yes.

Q. And he's a well-qualified preeminent scientist in the field of phosphorus transport. Do you agree with that?
A. He's a scientist working with phosphorus.
Q. You don't think he's preeminent?
A. Define preeminent.
Q. He's one of the top scientists in this field?
A. He's one of many, yes.
Q. Now, you agree, sir, that the Arkansas phosphorus index is a risk-based phosphorus management tool that considers phosphorus transport factors on a field-by-field basis?
A. Yes.
Q. And this was developed specifically for the use of poultry litter on pastures; right?
A. Yes, it was.
Q. You agree that this index considers transport factors such as slope; right?
A. Yes.

Q. Soil erosion?
A. Yes.
Q. Flooding frequency?
A. Yes.
Q. Timing of application?
A. Yes.
Q. Grazing management?
A. Yes.
Q. And the use of best management practices?
A. Yes.
Q. Now, the threshold or criteria you want this Court to adopt, the 65 STP doesn't consider any of those, does it?
A. No.

Q. You agree that Dr. Sharpley conducted a study and validated this phosphorus index, you agree?
A. He may well have done that.
Q. Let's look at Exhibit 3 real quick. This was in your documents. You recall this study by DeLaune, Moore, Carman, Sharpley, Haggard?
A. Yes, yes.
Q. The title is Evaluation of Phosphorus Source Component in the Phosphorus Index For Pastures?
A. Yes.
Q. Let's look at the end of the abstract. Upper left paragraph, bottom of it, please. There you go. Do you see the

last sentence in the end of the abstract?
A. Yes.
Q. It says these data indicate --
MR. NANCE: We've gone beyond the scope of direct considerably.
MR. MCDANIEL: Your Honor, he is telling this Court how this Court needs to adopt changes in the poultry litter management protocols. And I think it's important to this Court to understand the current criteria that are in place that consider important scientific transport factors that Dr. Johnson, in fact, does not consider.
THE COURT: Other than STP?
MR. MCDANIEL: Correct.
THE COURT: I understand. Mr. Nance.
MR. NANCE: Judge, his direct didn't deal with phosphorus transport at all. It dealt with what phosphorus is needed for the soil and that pertains to our argument that the

Court is aware of. We didn't get into any of this in direct.

THE COURT: I have to ask then, Mr. McDaniel, the transport factors have been discussed at length here and we really didn't get into that in direct. Why do we need to get into it on this witness in cross-examination?

MR. MCDANIEL: Two things, Your Honor. First, in the record of this case by virtue of his affidavit are the full breadth of his opinions regardless of those Mr. Nance chose to

inquire about. Second, when I asked him why he believed the rules needed to be changed to 65, he told you because anything over 65, besides not allowing for a phosphorus benefit, is environmentally unsound. And I, Your Honor, want to make the record that that is not an opinion that is held widely by the community that studies these things.

THE COURT: To the extent, Mr. Nance, Mr. McDaniel seeks to cross-examine on other matters raised in the affidavit, would that not be proper here?

MR. NANCE: I could be persuaded differently, but I don't recall that he talked about transport in the affidavit.

MR. MCDANIEL: Can I take Mr. Nance out and try to persuade him?

THE COURT: Well --

MR. MCDANIEL: Your Honor, if I can, the issue before the Court is shall you adopt 65 STP as a threshold in order to determine the applicability of RCRA, an environmental statute. I need to make a record for this Court that there is nobody else on the face of the earth that believes what this man believes, and that's what I'm doing.

THE COURT: Mr. Nance, any response?

MR. NANCE: The fact that nobody else on the face of

the world believes this, he couldn't establish through any testimony this witness could give. I'm looking at the affidavit.

MR. MCDANIEL: If Mr. Nance is willing to concede that Dr. Johnson's opinions have no relevance to whether poultry litter provides any effect upon the environment in this watershed, then I'll stop. I'll sit down. So you know, what do they want, Your Honor?

THE COURT: The objection is overruled.

MR. MCDANIEL: May I proceed?

THE COURT: Yes, sir.

MR. MCDANIEL: All right, thank you.

Q. (By Mr. McDaniel) Dr. Johnson, we're looking at Exhibit 3.

A. Yes.

Q. And the last sentence in the abstract says, "These data indicate that the P index for pastures can accurately assess the risk of phosphorus loss from fields receiving poultry litter applications in Arkansas and provide a more realistic assessment than threshold soil test phosphorus levels." Did I read that correctly?

A. Yes, you did.

Q. Would you agree, sir, that continuing in this report, Dr. Sharpley and his co-authors determined that even though more litter can be land applied to a field using the Arkansas phosphorus index than can be applied with a threshold like yours, the soluble phosphorus in the runoff is no higher if you employ this index. Isn't that what they found?

A. They found something similar to that, but not exactly what you've interpreted. What they found is that the soluble phosphorus in the runoff associated with soil test phosphorus is statistically significant and strongly correlated. In Figure 1A they show that. Then they further state that when they considered correlation between water soluble phosphorus in runoff and the contribution from soluble phosphorus in the litter and that from soil test phosphorus, that soil test phosphorus was no longer important. And they state so in their discussion under -- I believe it's Table 5 that you called attention to in my deposition.

Q. And they --

A. And they said that the addition of the soluble phosphorus in the litter overwhelms the influence of soil test phosphorus.

Q. Right, so if you're evaluating the risk of phosphorus loss on a field that has received litter, you agree that they found that this phosphorus index predicts it better than your soil test phosphorus?

A. No, it simply says -- in fact, it doesn't predict anything. It shows that you can use this index to categorize relative risk. My contention is that the minimal risk that NRCS proposes to advance in their 590 is to use a soil test of 65 and their paper shows that, that's when you have the minimum risk. You increase that risk when you add poultry litter.

Q. Go to page 8 in the exhibit, Dr. Johnson, under

conclusions.

A. Okay.

Q. The last sentence. These scientists, Dr. Sharpley concluded -- it starts with applications. "Application of

litter based on the P index allows more management options --"

A. Just a minute now, where are you at?

Q. You can see it on the screen, she's blown it up for you.

A. I was trying to find it here.

Q. Do you see where it is on the screen, Dr. Johnson?

A. Yeah, I see it.

Q. Dr. Sharpley and others say, "Application of litter based on the phosphorus index allows more management options than applications based on a soil test P threshold. These studies have provided evidence that the phosphorus index provides a better assessment of phosphorus runoff than Mehlich III soil test P, especially when litter P is added. That's what it says, doesn't it?

A. Yes, and I agree wholeheartedly.

Q. All right, thank you. Now, in fact, Dr. Johnson, you don't even believe poultry litter is a fertilizer. Isn't that what I heard you say?

A. I said it's not a very good fertilizer, yes.

Q. Not a very good fertilizer?

A. No.

Q. But it is a fertilizer?

A. Well, it's a source of nutrients.

Q. Yes or no, it is a fertilizer?

A. And you could call it a fertilizer. It is not registered as a fertilizer.

Q. And part of your affidavit, part of what Mr. Nance asked you, you have the opinion that it doesn't qualify as a soil amendment?

A. That's true.

Q. Let's look at Exhibit 18. This is OSU Production Technology Publication PT 98.7. Do you see that?
A. I'm looking for it.
Q. It's on the screen, but I'll be glad to help you find it. Who wrote this?
A. Yes.
Q. Who wrote this?
A. Dr. Hailin Zhang.
Q. Who is he?
A. He's the current extension soil nutrient management state specialist for soil nutrients.
Q. He is the nutrient management specialist for the State of Oklahoma?
A. That he is.
Q. Would you read aloud the first paragraph?
A. "Most people recognize the value of animal waste as a plant nutrient source or soil amendment but the potential of

manure, especially poultry litter, to neutralize soil acidity and raise soil pH is less known. On the contrary, some people even think manure lowers soil pH as some commercial nitrogen fertilizers do. Long-term field and greenhouse studies have demonstrated the liming effect of animal manure in acid and neutral soils."
Q. All right. From this publication you'd have to admit, Dr. Johnson, that Dr. Zhang and OSU Ag Extension Service disagree with you on whether poultry litter qualifies as a fertilizer and soil amendment. Do you agree?
A. I don't think they're saying whether or not it qualifies as an amendment. I believe they're saying that it has some properties that will serve as a soil amendment. They will

amend some soil properties.
Q. All right. She's going to bring up -- you recall giving your deposition; correct?
A. Yes.
Q. You remember us looking at this exhibit?
A. Yes, I must have said something different.
Q. I sure hope so.
MR. NANCE: Counsel, you're on page what?
Q. (By Mr. McDaniel) All right. Page 200, starting at line 23, the question, "But seriously Exhibit 23, the first statement here, it says most people recognize the value -- we're referring to this document -- most people recognize the

value of a animal waste as a plant nutrient source for soil amendment.
"Then we go down to the last statement that says, therefore, applying manure to acid soils not only supply much needed nutrients and organic matter for plant growth, but it also reduces soil acidity, thus improving phosphorus availability and reduce aluminum toxicity. In Oklahoma, many fields are acidic and animal manure would be good amendment. So you don't disagree with me, sir, that OSU is taking the position that animal manure is a soil amendment?
"Answer: That's what he said, that's what he stated, yes."
A. Yes, and I would say that's what he stated again.
Q. Let's look real quickly at Exhibit 13. This was in your file too, wasn't it?
A. Yes.
Q. Poultry litter transport from the Illinois River

Watershed, Oklahoma to non-nutrient limited watersheds program administered by the Oklahoma Conservation Commission dated September 2007. Do you agree?

A. Yes.

Q. All right. Were you aware that the Oklahoma Conservation Commission was operating a program under an EPA grant to export litter from the watershed?

A. You know, I read this. At the time of the deposition, if

you asked me if I knew about this without looking at this document, I probably would have had to say no.

Q. Let's go to what is actually page 14, the Bates number ends with 901. And Ms. Ferguson is going to blow it up on the screen, what I want to look at.

A. Okay.

Q. All right. You see the bold header that says, "Litter transfer out of the Illinois River Watershed through the program"?

A. Yes.

Q. And it says, "The program moved 49,596 tons of litter from the Illinois River Watershed into non-nutrient limited or non-nutrient threatened watersheds in Oklahoma between May 2005 and December 2006." Did I read that right?

A. Yes.

Q. All right. It also says, "Assuming that approximately 231,000 tons of litter is produced in the watershed annually," and it cites to Storm 2006. Who is Storm?

A. He's a faculty member in the biosystems and ag engineering department.

Q. All right. So according to this 2007 document, the Conservation Commission is estimating 231,000 tons of litter in

the watershed. Do you agree?
A. I agree with what you are reading.
Q. All right. Now, this export of this 49,596 tons, you

didn't consider that in forming your opinions about the excess of manure or phosphorus in this watershed, did you?
A. No.
Q. Let's look at Exhibit 14. There's already been evidence about BMP's reported export, Exhibit 14, BMP's report to the Oklahoma Scenic Rivers Commission. Do you see where she reports 74,256 tons from September '06 to August '07? Do you see that?
A. Yes, I see that.
Q. Did you consider that in your opinions about phosphorus export?
A. No, no.
Q. Or excuse me, phosphorus excess? Would you agree that this litter is more than likely coming from poultry farmers who cannot put down poultry litter because of the current laws? Makes sense, doesn't it?
A. Makes sense.
Q. Now, Exhibit 21 was --
A. Well, they may have just found a good market for it.
Q. Exhibit 21 was in your documents. Oklahoma's Non-point Source Management Program and Non-point Source Assessment Report 2000 to 2015 Priority Watersheds From the Oklahoma Conservation Commission Water Quality Programs. Did you read this document, sir?
A. No.

Q. Were you familiar that the Conservation Commission had developed a non-point source management program for watersheds in Oklahoma under the Federal Clean Water Act?
A. No.
MR. NANCE: We're beyond the scope of direct and he says he didn't read it, so he doesn't have personal knowledge of it.
MR. MCDANIEL: Came from his file, Your Honor, said in his reliance materials.
A. Well, I have --
THE COURT: Overruled, go ahead.
A. -- thousands of documents in my files that you were provided that I may have looked at or downloaded and may have read two years ago, but certainly weren't considered in the development of my opinion.
Q. (By Mr. McDaniel) Okay. So you can tell me then the opinion you've offered this Court, you have no idea how this state program would affect those opinions?
A. That's true.
Q. Have you -- Dr. Johnson, have you qualified the water quality effects, if any, in the Illinois River Watershed if litter use is banned?
A. Have I qualified them?
Q. Quantified.
A. Quantified them, no.

Q. Did you quantify the forage yield production in the Illinois River Watershed if litter is banned?
A. No.
THE COURT: All right, I think we are beyond the scope

at this point, plus it's 5:30. We need to recess. We'll reconvene at 9:00 o'clock tomorrow morning.

A TRUE AND CORRECT TRANSCRIPT.

CERTIFIED: s/ Glen R. Dorrough
Glen R. Dorrough
United States Court Reporter